Project Manual – Volume I

For Bid Pac G-1

New Dover High School

Dover, Delaware

EDiS Company, Inc.

Becker Morgan Group, Inc.

ABHA Architects

Capital School District

March 1, 2013

TABLE OF CONTENTS - VOLUME 1

Division 0 - Bidding and Contract Requirements

00 01 10 Table of Contents
00 01 15 List of Drawings
00 11 13 Advertisement for Bids
00 21 13 Instructions to Bidders
00 31 28 Conductivity Well Test Report
00 31 32 Geotechnical Data
00 41 00 Bid Forms Including:
Sub Listing
Bid Bond
Non-Collusion Statement
Consent of Surety
00 52 00 Agreement Forms
00 61 13 Performance and Payment Bond Forms
00 62 16 Certificate of Insurance
00 72 00 General Conditions
00 73 00 Supplementary Conditions
00 73 43 Wage Rate Requirements

Division 01 - General Requirements

01 11 00 Summary of Work
01 21 00 Allowances
01 22 00 Unit Prices
01 23 00 Alternates
01 26 00 Change Order Procedures
01 26 13 Contractor Compensation
01 29 00 Payment Procedures
01 31 13 Project Coordination Meetings
01 31 16 BIM Modeling Coordination Drawing Guidelines
01 31 19 Pre-installation Meetings
01 31 25 Web Based Project management System
01 32 16 Construction Progress Schedule
01 32 19 Submittals Register
01 32 26 Contractors Daily Reports
01 33 00 Submittal Procedures
01 35 00 Contractor Employee Background Check
01 35 23 Safety Program
01 45 00 Quality Control
01 51 13 Temporary Electricity
01 51 23 Temporary Heating, Cooling, and Ventilating
01 52 00 Construction Facilities & Temporary Controls

01 62 00 Material and Equipment
01 71 23 Field Engineering
01 73 29 Cutting and Patching
01 74 19 Construction Waste Management and Disposal
01 77 00 Closeout Procedures
01 81 13 Sustainable Design Requirements LEED for Schools
01 91 13 General Commissioning Requirements
01 91 14 Plumbing Commissioning Requirements
01 91 15 HVAC Commissioning Requirements
01 91 16 Electrical Systems Commissioning Requirements

Division 02 – Existing Conditions
Not Used

Division 03 – Concrete
03 30 00 Cast-in-Place Concrete

Division 04 – Masonry
04 20 00 Unit Masonry
04 72 00 Cast Stone Masonry

Division 05 – Metals
05 12 00 Structural Steel Framing
05 21 00 Steel Joist Framing
05 31 00 Steel Decking
05 40 00 Cold-Formed Metal Framing
05 50 00 Metal Fabrications

Division 06 – Wood, Plastics, and Composites
06 10 00 Rough Carpentry
06 20 00 Finish Carpentry

Division 07 – Thermal and Moisture Protection
07 21 00 Thermal Insulation
07 26 40 Spray Polyurethane Foam Insulating Air Barrier
07 26 16 Under-Slab Vapor Barrier/Retarder
07 42 13 Metal Wall Panels
07 53 00 Elastomeric Membrane Roofing
07 62 00 Sheet Metal Flashing And Trim
07 71 00 Roof Specialties
07 72 00 Roof Accessories
07 84 13 HVAC & Plumbing Penetration Firestopping
07 90 05 Joint Sealers

Division 08 – Openings

08 06 71 Doors Hardware Schedule
08 11 13 Hollow Metal Doors And Frames
08 33 23 Overhead Coiling Doors
08 33 33 Coiling Counter Doors
08 43 13 Aluminum-Framed Strorefronts
08 56 55 Ticket Windows
08 71 00 Door Hardware
08 80 00 Glazing
08 91 00 Louvers

Division 09 – Finishes
09 05 61 Common Work Results for Flooring Preparation
09 21 16 Gypsum Board Assemblies
09 51 00 Acoustical Ceilings
09 65 66 Resilient Athletic Flooring
09 67 00 Fluid-Applied Flooring
09 68 13 Tile Carpeting
09 90 00 Painting and Coating

Division 10 – Specialties
10 11 01 Visual Display Boards
10 21 13.19 Solid Composite Toilet Compartments
10 28 00 Toilet, Bath and Laundry Accessories
10 44 00 Fire Protection Specialties
10 51 00 Lockers

Division 11 – Equipment
11 40 00 Food Service Equipment
11 68 20 Outdoor Athletic Equipment
11 68 33 Stadium Padding

Division 12 – Furnishings
12 24 13 Window Treatment – Roller Shades
12 34 00 Laminate Clad Casework
12 36 00 Countertops and Backsplashes
12 93 13 Site Furnishings

Division 13 – Special Construction
13 34 16 Grandstands and Bleachers

Division 14 – Conveying Equipment
Not Used

Division 15 Reserved
Not Used

Division 16 Reserved
Not Used

Division 17 Reserved
Not Used

Division 18 Reserved
Not Used

Division 19 Reserved
Not Used

Division 20 Reserved
Not Used

Division 21 – Fire Suppression
Not Used

Division 22 – Plumbing
22 05 00 Common Work Results For Plumbing
22 05 05 Plumbing Piping, Fittings And Valves
22 07 01 Plumbing Insulation
22 11 13 Facility Water Distribution Piping
22 13 13 Facility Sanitary Sewers
22 40 00 Plumbing Fixtures
22 40 05 Plumbing Equipment

Division 23 – Heating Ventilating and Air Conditioning
23 05 00 Common Work Results For Hvac
23 05 05 Hvac Piping, Fittings And Valves
23 05 48 Vibration Controls For Hvac, Plumbing And Fire Protection Equipment
23 05 93 Testing, Adjusting And Balancing For Hvacand Plumbing
23 06 00 Heating, Ventilating And Air Conditioning Equipment
23 07 01 Hvac Insulation
23 09 00 Automatic Temperature Control
23 30 00 Hvac Air Distribution
23 81 26 Variable Refrigerant Volume Split Systems With Heat Recovery (Air Cooled Systems

Division 24 Reserved
Not Used

Division 25 – Integrated Automation
Not Used

Division 26 – Electrical
26 05 00 Common Work Results For Electrical
26 05 13 Medium Voltage Cables
26 05 19 Low Voltage Electrical Power Conductors And Cables
26 05 26 Grounding And Bonding For Electrical Systems
26 05 29 Hangers And Supports For Electrical Systems
26 05 33 Raceway And Boxes For Electrical Systems
26 09 23 Lighting And Branch Circuit Control Devices
26 09 43 Expansion Of Lutron Quantum Lighting Controls
26 11 18 Outdoor Switchgear
26 12 00 Pad-Mounted Transformers, Liquid Filled
26 22 00 Low-Voltage Transformers
26 24 16 Panelboards
26 27 16 Electrical Cabinets And Enclosures
26 27 26 Wiring Devices
26 28 19 Enclosed Switches
26 28 23 Enclosed Circuit Breakers
26 29 13 Enclosed Controllers
26 41 00 Facility Lightning Protection
26 50 00 Lighting
26 56 00 Athletic Field Sports Lighting

Division 27 – Communications
Not Used

Division 28 – Electronic Safety and Security
28 31 10 Fire Alarm System Expansion

Division 29 Reserved
Not Used

Division 30 Reserved
Not Used

Division 31 – Earthwork
31 10 00 Site Clearing
31 20 00 Earth Moving
31 23 19 Dewatering
31 31 16 Termite Control
31 50 00 Excavation Support And Protection

Division 32 – Exterior Improvements
32 12 16 Asphalt Paving
32 13 13 Concrete Paving
32 13 73 Concrete Paving Joint Sealants

32 14 00 Unit Paving
32 18 17 Synthetic Track Surfacing System
32 18 18 Tennis Court Pavement System
32 31 13 Chain Link Fences
32 31 19 Decorative Fences And Gates
32 84 00 Plant Irrigation
32 92 00 Meadow Planting
32 92 23 Lawns
32 93 00 Plants

Division 33 – Utilities
33 05 00 Common Work Results For Utilities
33 41 00 Storm Utility Drainage Piping
33 46 00 Subdrainage
33 71 19 Electrical Underground Ducts, Handholes, Pullboxes
33 71 73 Electrical Utility Services

Division 34 – Transportation
Not Used

Division 35 – Waterway and Marine Construction
Not Used

Division 36 Reserved
Not Used

Division 37 Reserved
Not Used

Division 38 Reserved
Not Used

Division 39 Reserved
Not Used

SECTION 00 01 15 - LIST OF DRAWINGS

DRWG NO.	DRAWING NAME	ISSUE DATE
	Bid Package G-Volume I	
G-001.G	Volume I - Bid Pac G - Cover Sheet	10-31-12
G-002.G	Drawing List	10-31-12
C-001	Cover Sheet & Overall Layout	10-29-12
C-101C	Existing Conditions Plan	
C-102C	Existing Conditions Plan	
C-201C	Site, Signage And Striping Plan	10-29-12
C-202C	Site, Signage And Striping Plan	10-29-12
C-203C	Site, Signage And Striping Plan	10-29-12
C-204C	Site, Signage And Striping Plan	10-29-12
C-205C	Site, Signage And Striping Plan	10-29-12
C-206C	Site, Signage And Striping Plan	10-29-12
C-301C	Utilities Plan	10-29-12
C-302C	Utilities Plan	10-29-12
C-303C	Utilities Plan	10-29-12
C-304C	Utilities Plan	10-29-12
C-305C	Utilities Plan	10-29-12
C-306C	Utilities Plan	10-29-12
C-307C	Utilities Plan	
C-400C	Overall Grading Plan And Key Sheet	
C-401C	Grading Plan	
C-402C	Grading Plan	
C-403C	Grading Plan	
C-404C	Grading Plan	
C-405C	Grading Plan	
C-406C	Grading Plan	
C-500C	Erosion & Sediment Control Key Sheet	
C-501C	Erosion & Sediment Control Plan	
C-502C	Erosion & Sediment Control Plan	
C-503C	Erosion & Sediment Control Plan	
C-504C	Erosion & Sediment Control Plan	
C-505C	Erosion & Sediment Control Plan	
C-506C	Erosion & Sediment Control Plan	
C-509C	Erosion & Sediment Control Details	
C-510C	Erosion & Sediment Control Details	
C-511C	Erosion & Sediment Control Phasing Plan	
C-901C	Construction Details	
C-902C	Construction Details	
C-903C	Construction Details	
C-904	Baseball Field Details	
C-905	Softball Field Details	
C-906	Field Striping & Goal Details	
C-907	Field Striping & Goal Details	

C-908 Athletic Courts & Equipment Details	
C-909 Track & Field Details (Main Stadium)	
C-910 Auxilary Field Details	
L1.0 Overall Landscape Key Plan	10-29-12
L1.1 Planting Soils Layout Plan – West	10-29-12
L1.2 Planting Soils Layout Plan – East	10-29-12
L2.0 Hardscape Plan - West Courtyard Enlargement	10-29-12
L2.1 Hardscape Plan - East Courtyard Enlargement	10-29-12
L2.2 Hardscape Plan - Stadium Plaza Enlargement	10-29-12
L2.3 Hardscape Plan - Stadium Plaza Enlargement	10-29-12
L2.4 Landscape Plan - Visitor Entry & Concessions Enlargement	10-29-12
L2.5 Fence Type Diagram	10-29-12
L2.6 Hardscape Layout Plan - West Courtyard	10-29-12
L2.7 Hardscape Layout Plan - Stadium Plaza	10-29-12
L2.8 Hardscape Layout Plan - Stadium Plaza	10-29-12
L3.0 Hardscape Details	10-29-12
L3.1 Hardscape Details	10-29-12
L3.2 Hardscape Details	10-29-12
L3.3 Hardscape Details	10-29-12
L4.0 Landscape Plan	10-29-12
L4.1 Landscape Plan	10-29-12
L4.2 Landscape Plan	10-29-12
L4.3 Landscape Plan	10-29-12
L4.4 Landscape Plan	10-29-12
L4.5 Landscape Plan	10-29-12
L4.6 Landscape Plan - Enlargement	10-29-12
L4.7 Landscape Plan - Enlargement	10-29-12
L4.8 Bio-Retention Area 1 Planting Plan	10-29-12
L4.9 Overall Meadow Planting Plan	10-29-12
L4.10 Schematic Irrigation Plan	10-29-12
L4.10.1 Schematic Irrigation Plan	
L4.11 Planting Details	10-29-12
SF-100 Structural Notes	11-1-12
SF-111 Foundation Plan - Area Fh (Fieldhouse)	11-1-12
SF-112 Roof Framing Plan - Area Fh (Fieldhouse)	11-1-12
SF-121 Ball Field Concession Foundation & Roof Framing Plan	11-1-12
SF-131 Baseball Field Dugout - Foundation, Roof Framing Plan & Sections	
SF-132 Softball Field Dugout - Foundation, Roof Framing Plan & Sections	
SF-201 Sections & Details	11-1-12
SF-301 Typical Sections And Details	11-1-12
SP-100 Site Keyplan - Overall	11-1-12
SP-101 Site Plan - Partial	11-1-12
SP-102 Site Plan - Partial	11-1-12
AF-003 Partition Schedule	10-31-12
AF-101 Overall Plan - Fieldhouse	10-31-12
AF-102 Overall Plan - Ball Field	10-31-12
AF-111 First Floor Plan - Area Fh (Fieldhouse)	10-31-12
AF-112 First Floor Rcp - Area Fh (Fieldhouse)	10-31-12
AF-113 First Floor Finish Plan - Area Fh (Fieldhouse)10-31-12	

AF-114 First Floor Furniture Plan - Area Fh (Fieldhouse)	10-31-12
AF-121 Building Plans - Remote Athletics Building And Maintenance Building - Alternate	10-31-12
AF-131 Floor Plan - Baseball Dugout	10-31-12
AF-132 Floor Plan - Softball Dugout	10-31-12
AF-211 Elevations - Fieldhouse - Fb	10-31-12
AF-221 Elevations - Remote Athletics Building And Maintenance Building - Alternate	10-31-12
AF-231 Elevations - Ballfield Dugouts	10-31-12
AF-301 Building Sections	10-31-12
AF-302 Building Sections	10-31-12
AF-303 Building Sections	10-31-12
AF-304 Building Sections – Alternate	10-31-12
AF-331 Wall Sections	10-31-12
AF-332 Wall Sections	10-31-12
AF-333 Wall Sections	10-31-12
AF-335 Wall Sections	10-31-12
AF-336 Wall Sections - Alternate	10-31-12
AF-337 Wall Sections - Alternate	10-31-12
AF-338 Wall Sections - Alternate	10-31-12
AF-401 Enlarged Toilet Plans	10-31-12
AF-402 Toilet Room Elevations	10-31-12
AF-450 Football Bleachers (Home) - Section View	10-1-12
AF-451 Football Bleachers (Home) - Section View Ramp & Exit Details	10-1-12
AF-452 Football Bleachers (Visitor) - Section View	10-1-12
AF-453 Football Bleachers (Home & Visitor) - Base Seating Layout	10-1-12
AF-454 Football Bleachers (Home & Visitor) - Base Footing Layouts	10-1-12
AF-455 Football Bleachers (Home & Visitor) - Alternate Seating Layouts	10-1-12
AF-456 Football Bleachers (Home & Visitor) - Alternate Footing Layouts	10-1-12
AF-457 Football Bleachers (Home) - Pressbox Details	10-1-12
AF-458 Football Bleachers (Visitor) - Ramp & Exit Details	10-1-12
AF-459 Football Bleachers (Home & Visitor) - Site Plan	10-1-12
AF-460 Football Bleachers (Home) - Front Elevation Views (Base & Alternate Bids)	10-1-12
AF-461 Baseball Bleachers - Section View	10-1-12
AF-462 Baseball Bleachers - Section View	10-1-12
AF-463 Baseball Bleachers - Seating Layout	10-1-12
AF-464 Baseball Bleachers - Footing Layout	10-1-12
AF-465 Baseball Bleachers - Ramp & Exit Details	10-1-12
AF-466 Baseball - Pressbox Details	10-1-12
AF-467 Softball Bleachers - Section View	10-1-12
AF-468 Softball Bleachers - Section View	10-1-12
AF-469 Softball Bleachers - Seating Layout	10-1-12
AF-470 Softball Bleachers - Footing Layout	10-1-12
AF-471 Softball Bleachers Ramp & Exit Details	10-1-12
AF-472 Alternate - Soccer Bleachers - Section View	10-1-12
AF-473 Alternate - Soccer Bleachers - Seating & Footing Layout	10-1-12
AF-474 Alternate - Soccer Bleachers - Ramp & Exit Details	10-1-12
AF-475 Footing & Grade Beams Designs	10-1-12
AF-480 Casework Elevations	10-31-12
AF-530 Plan Details	10-31-12
AF-550 Vertical Details	10-31-12

AF-590 Dave - Roof Details	10-31-12
AF-600 Door Schedule & Details	10-31-12
AF-610 Window Schedule	10-31-12
PF-111-D Stadium Fieldhouse - North Wing - Plumbing	10-1-12
PF-111-S Stadium Fieldhouse - North Wing - Plumbing	10-1-12
PF-112-D Stadium Fieldhouse - East Wing - Plumbing10-1-12	
PF-112-S Stadium Fieldhouse - East Wing - Plumbing10-1-12	
PF-113-D Stadium Fieldhouse - West Wing - Plumbing	10-1-12
PF-113-S Stadium Fieldhouse - West Wing - Plumbing10-1-12	
PF-114-D Baseball Fieldhouse - Plumbing	10-1-12
PF-114-S Baseball Fieldhouse - Plumbing	10-1-12
PF-115 Stadium Fieldhouse - North Wing Roof Plan - Plumbing	
PF-116 Stadium Fieldhouse - East Wing Roof Plan - Plumbing	
PF-117 Stadium Fieldhouse - West Wing Roof Plan - Plumbing	
PF-118 Baseball Fieldhouse - Roof Plan - Plumbing	
PF-301 Details - Plumbing	10-1-12
PF-302 Details - Plumbing	10-1-12
PF-303 Details - Plumbing	10-1-12
PF-401 Schedules - Plumbing	10-1-12
PF-501 Risers Plumbing	
PF-502 Risers Plumbing	
MF-111 Stadium Fieldhouse - North Wing - Hvac	10-1-12
MF-112 Stadium Fieldhouse - East Wing - Hvac	10-1-12
MF-113 Stadium Fieldhouse - West Wing - Hvac	10-1-12
MF-114 Baseball Fieldhouse - Hvac	10-1-12
MF-201 Details Hvac	10-1-12
MF-202 Details Hvac	
MF-203 Details Hvac	
MF-301 Schedules Hvac	
EF-100 Electrical Notes, Schedules & Legend	11-2-12
EF-101 Electrical Site Plan - Parts 1 & 2 - Underground Conduit System	11-2-12
EF-102 Electrical Site Plan - Part 3 - Underground Conduit System	11-2-12
EF-103 Electrical Site Details	11-2-12
EF-141 Electrical Power Plans Stadium Fieldhouses Ball Field Building Maintenance Building	
EF-241 Electrical Lighting Plans stadium Fieldhouses Ball Field Building Maintenance Building	
EF-300 Electrical Plans Stadium Bleachers Baseball Bleachers Softball Bleachers Soccer Bleachers	
EF-600 Electrical Single Line Diagram	
EF-700 Electrical Panel Schedules	
EF-701 Electrical Panel & Lighting Fixture Schedules	

<u>Bid Package F-Volume II</u>

II G-001.F	Volume II – Bid Pac F – Cover Sheet	5/21/12
II G-002.F	Volume II – Bid Pac F – Drawing List	5/21/12
A-510	Plan Details – Areas A, B, C	5/21/12
A-511	Plan Details – Areas A, B, C	5/21/12
A-512	Plan Details – Areas A, B, C	5/21/12
A-513	Plan Details – Areas A, B, C	5/21/12
A-514	Plan Details – Areas A, B, C	5/21/12
A-521	Exterior Plan Details	5/21/12

A-522	Exterior Plan Details	5/21/12
A-523	Exterior Plan Details	5/21/12
A-524	Interior Plan Details	5/21/12
A-525	Interior Plan Details	5/21/12
A-526	Interior Plan Details	5/21/12
A-531	Plan Details – Areas F, G, H	5/21/12
A-532	Plan Details – Areas F, G, H	5/21/12
A-533	Plan Details – Areas F, G, H	5/21/12
A-534	Plan Details – Areas F, G, H	5/21/12
A-535	Plan Details – Areas F, G, H	5/21/12
A-536	Plan Details – Areas F, G, H	5/21/12
A-537	Plan Details – Areas F, G, H	5/21/12
A-551	Vertical Details – Areas A, B, C	5/21/12
A-552	Vertical Details – Areas A, B, C	5/21/12
A-553	Vertical Details – Areas A, B, C	5/21/12
A-554	Vertical Details – Areas A, B, C	5/21/12
A-555	Vertical Details – Areas F, G, H	5/21/12
A-556	Vertical Details – Areas F, G, H	5/21/12
A-557	Vertical Details – Areas F, G, H	5/21/12
A-558	Vertical Details – Areas F, G, H	5/21/12
A-559	Vertical Details – Areas F, G, H	5/21/12
A-561	Section Details	5/21/12
A-562	Section Details	5/21/12
A-563	Section Details	5/21/12
A-564	Section Details	5/21/12
A-565	Section Details	5/21/12
A-571	Ceiling Details	5/21/12
A-572	Ceiling Details	5/21/12
A-573	Ceiling Details	5/21/12
A-574	Ceiling Details	5/21/12
A-575	Casework Details	5/21/12
A-581	Casework Elevations & Details	5/21/12
A-582	Casework Elevations & Details	5/21/12
A-583a	Casework Elevations & Details	5/21/12
A-583b	Casework Elevations & Details	5/21/12
A-584	Auditorium Acoustic Panels	5/21/12
A-585	Auditorium Acoustic Panels	5/21/12
A-586	Casework Elevations & Details	5/21/12
A-587	Casework Elevations & Details	5/21/12
A-588	Casework Elevations & Details	5/21/12
A-601	Door Schedule	5/21/12
A-602	Door Schedule	5/21/12
A-603	Door Schedule	5/21/12
A-604	Door Schedule	5/21/12
A-605	Door & Frame Types	5/21/12

A-606	Door & Frame Types	5/21/12
A-610	Window Schedule	5/21/12
A-611	Window & Louver Schedule	5/21/12
A-612	Window Schedule	5/21/12
A-613	Vision Panel Schedule	5/21/12
A-614	Window Details	5/21/12
A-615	Window Details	5/21/12
A-616	Window Details	5/21/12
A-620	Window Schedule	5/21/12
A-621	Window Schedule	5/21/12
A-622	Window Schedule	5/21/12
FS-1	Kitchen Servery Layout	5/21/12
FS-2	Culinary Arts Layout	5/21/12
FS-3	Kitchen Servery Utility	5/21/12
FS-4	Culinary Arts Utility	5/21/12
I-001	Finish Legend & Schedule	5/21/12
I-101	Overall Finish Plan – First Floor	5/21/12
I-102	Overall Finish Plan – Second Floor	5/21/12
I-103	Overall Finish Plan – Third Floor	5/21/12
I-111	First Floor Finish Plan – Area A (KCCS, Special Needs & Partial Admin.)	5/21/12
I-111P	First Floor Floor Pattern Plan – Area A (KCCS, Special Needs & Partial Admin.)	5/21/12
I-112	First Floor Finish Plan – Area B (Administration, Guidance, Health & Wellness Center)	5/21/12
I-112P	First Floor Floor Plan – Area B (Administration, Guidance, Health & Wellness)	5/21/12
I-113	First Floor Finish Plan – Area C (9th Grade Academy)	5/21/12
I-113P	First Floor Floor Pattern Plan – Area C (9th Grade Academy)	5/21/12
I-114	First Floor Finish Plan – Area D (Student Dining)	5/21/12
I-114P	First Floor Finish Pattern Plan - D (Student Dining	5/21/12
I-115	First Floor Finish Plan – Area E (Theater)	5/21/12
I-115P	First Floor Finish Pattern Plan – Area E (Theater)	5/21/12
I-116	`First Floor Finish Plan – Area F (Culinary Arts)	5/21/12
I-116P	First Floor Floor Pattern Plan – Area F (Culinary Arts)	5/21/12
I-117	First Floor Finish Plan – Area G (Gymnasium)	5/21/12
I-117P	First Floor Floor Pattern Plan – Area G (Gymnasium)	5/21/12
I-118	First Floor Finish Plan – Area H (Career Technology & Physical Education)	5/21/12
I-118A	Add Alternate A-3BPF – Area H – Finish & Floor Pattern Plan	5/21/12
1-118P	First Floor Floor Pattern Plan – Area H (Auxiliary Gymnasium)	5/21/12
I-119	First Floor Finish Plan – Area I (Main Street)	5/21/12
I-119P	First Floor Finish Pattern Plan – Part J (Main Street)	5/21/12
I-121	Second Floor Finish Plan – Area A (English and World Language Academies)	5/21/12
I-121P	Second Floor Floor Pattern Plan – Area A (English and World Language Academies)	5/21/12
I-122	Second Floor Finish Plan – Area B (Media Center)	5/21/12
I-122P	Second Floor Floor Pattern Plan – Area B (Media Center)	5/21/12
I-123	Second Floor Finish Plan – Area C (History/Social Science Academies)	5/21/12
I-123P	Second Floor Floor Pattern Plan – Area C (History/Social Science Academies)	5/21/12
I-125	Second Floor Finish Plan Area E (Theater)	5/21/12
I-125P	Second Floor Finish Pattern Paln Part E (Theater)	5/21/12

I-131	Third Floor Floor Finish Plan – Area A (Math Academy)	5/21/12
I-131P	Third Floor Floor Pattern Plan – Area A (Math Academy)	5/21/12
I-132	Third Floor Finish Plan – Area B (Lecture Hall & Science)	5/21/12
I-132P	Third Floor Floor Pattern Plan – Area B (Lecture Hall & Science)	5/21/12
I-133	Third Floor Finish Plan – Area C (Science Academy)	5/21/12
I-133P	Third Floor Floor Pattern Plan – Area C (Science Academy)	5/21/12
I-134	Interior Finish Elevations	5/21/12
I-141	First Floor Furniture Plan – Area A (KCCS, Special Needs & Partial Administration)	5/21/12
I-142	First Floor Furniture Plan – Area B (Administration, Guidance, Health & Wellness Center)	5/21/12
I-143	First Floor Furniture Plan – Area C (9th Grade Academy)	5/21/12
I-144	First Floor Furniture Plan – Area D (Student Dining)	5/21/12
I-145	First Floor Furniture Plan – Area E (Theater)	5/21/12
I-146	First Floor Furniture Plan – Area F (Culinary and Visual Arts)	5/21/12
I-147	First Floor Furniture Plan – Area G (Athletics)	5/21/12
I-148	First Floor Furniture Plan – Area H (Career Technology and Physical Education)	5/21/12
I-151	Second Floor Furniture Plan – Area A (English Academy)	5/21/12
I-152	Second Floor Furniture Plan – Area B	5/21/12
I-153	Second Floor Furniture Plan – Area C (History & Social Studies)	5/21/12
I-161	Third Floor Furniture Plan – Area A (Math Academy)	5/21/12
I-162	Third Floor Furniture Plan – Area B (Lecture Hall & Science)	5/21/12
I-163	Third Floor Furniture Plan - Area C (Science Labs)	5/21/12
		5/21/12

Bid Package F-Volume I

I G-001.F	Volume I - Bid Pac F - Cover Sheet	5/21/12
I G-002.F	Volume I - Bid Pac F - Drawing List	5/21/12
A-001	Partition Schedule	5/21/12
A-002	Partition Schedule	5/21/12
A-003	Exterior Assembly & Interior Partition Schedule	5/21/12
A-101	Overall Floor Plan - First Floor	5/21/12
A-102	Overall Floor Plan - Second Floor	5/21/12
A-103	Overall Floor Plans - Third Floor And Equipment Platform Level	5/21/12
A-104	Overall Plan – Roof	5/21/12
A-111	First Floor Plan – Area A (Special Needs, KCCS & Partial Admin	5/21/12
A-112	First Floor Plan – Area B (Administration, Guidance, Health & Wellness Center)	5/21/12
A-113	First Floor Plan – Area C (Ninth Grade Academy)	5/21/12
A-114	First Floor Plan – Part D (Student Dining)	5/21/12
A-115	First floor Plan – Part E (Theater)	5/21/12
A-116	First Floor Plan – Area F (Culinary and Visual Arts)	5/21/12
A-117	First Floor Plan – Area G (Athletics)	5/21/12
A-118	First Floor Plan – Area H (Career Technology and Physical Education)	5/21/12
A-118A	Add Alternate A-3BPF – Area "H'	5/21/12
A-119	First Floor Plan – Part J (Main Street)	5/21/12
A-120	First Floor Slab Plan – Area A (English and World Languages Academies)	5/21/12
A-121	Second Floor Plan – Area A (English and World Languages Academies)	5/21/12
A-122	Second Floor Plan – Area B	5/21/12
A-123	Second Floor Plan – Area C (History/Social Sciences Academies)	5/21/12
A-124	Second Floor plan – Part D (Equipment Platform)	5/21/12

A-125	Second Floor Plan – Part E (Theater)	5/21/12
A-126	Second Floor Plan – Part E (Catwalk Level)	5/21/12
A-127	Upper Level Floor Plan – Areas G&H	5/21/12
A-131	Third Floor Plan – Area A (Math Academy)	5/21/12
A-132	Third Floor Plan – Area B (Lecture Hall & Science)	5/21/12
A-133	Third Floor Plan – Area C (Science Academy)	5/21/12
A-134	Upper Level Floor Plan (Equipment Platform) – Area A	5/21/12
A-135	Upper Level Floor Plan (Equipment Platform) – Area C	5/21/12
A-161	First Floor RCP – Overall	5/21/12
A-162	Second Floor RCP – Overall	5/21/12
A-163	Third Floor RCP – Overall	5/21/12
A-171	First Floor RCP- Area A (Special Needs, KCCS, partial Admin)	5/21/12
A-172	First Floor RCP – Area B (Administration, Guidance, Health & Wellness Center)	5/21/12
A-173	First Floor RCP- Area C (Ninth Grade Academy)	5/21/12
A-174	First Floor RCP – Area D (Student Dining)	5/21/12
A-175	First Floor RCP – Area E (Theater)	5/21/12
A-176	First Floor RCP – Area F (Culinary and Visual Arts)	5/21/12
A-177	First Floor RCP – Area G (Athletics)	5/21/12
A-178	First Floor RCP – Area H (Career Technology and Physical Education)	5/21/12
A-179	First Floor RCP – Area I (Main Street)	5/21/12
A-181	Second Floor RCP – Area A (English and World Languages Academies)	5/21/12
A-182	Second Floor RCP – Area B	5/21/12
A-183	Second Floor RCP – Area C (History/Social Sciences Academies)	5/21/12
A-184	Second Floor RCP – Part D (Equipment Platform)	5/21/12
A-185	Second Floor RCP – Part E (Theater)	5/21/12
A-191	Third Floor RCP – Area A (Math Academy)	5/21/12
A-192	Third Floor RCP – Area B (Lecture Hall & Science)	5/21/12
A-193	Third Floor RCP – Area C (Science Academy)	5/21/12
A-301	Building Sections	5/21/12
A-302	Building Sections	5/21/12
A-304	Building Sections	5/21/12
A-311	Partial Building Sections	5/21/12
A-312	Partial Building Sections	5/21/12
A-313	Building Sections	5/21/12
A-314	Building Sections	5/21/12
A-315	Building Sections	5/21/12
A-318	Partial Building Sections	5/21/12
A-331	Wall Sections	5/21/12
A-332	Wall Sections	5/21/12
A-333	Wall Sections	5/21/12
A-334	Wall Sections	5/21/12
A-335	Wall Sections	5/21/12
A-336	Wall Sections	5/21/12
A-337	Wall Sections	5/21/12
A-338	Wall Sections	5/21/12
A-339	Wall Sections	5/21/12
A-340	Wall Sections	5/21/12
A-341	Wall Sections	5/21/12
A-342	Wall Sections - Rotunda	5/21/12

A-343	Wall Sections - Library	5/21/12
A-344	Wall Sections	5/21/12
A-345	Sections – Entrance Canopy	5/21/12
A-346	Wall Sections	5/21/12
A-347	Wall Sections	5/21/12
A-348	Wall Sections	5/21/12
A-349	Wall Sections	5/21/12
A-350	Wall Sections	5/21/12
A-351	Wall Sections	5/21/12
A-352	Wall Sections	5/21/12
A-353	Wall Sections	5/21/12
A-354	Wall Sections	5/21/12
A-355	Wall Sections	5/21/12
A-356	Wall Sections	5/21/12
A-357	Wall Sections – Main Gym	5/21/12
A-358	Wall Sections	5/21/12
A-359	Wall Sections/Canopy Details	5/21/12
A-360	Wall Sections	5/21/12
A-361	Wall Sections – Area H	5/21/12
A-362	Wall Sections - Pilaster	5/21/12
A-363	Wall Sections	5/21/12
A-364	Wall Sections	5/21/12
A-365	Wall Sections	5/21/12
A-366	Wall Sections	5/21/12
A-401	Enlarged Toilet Plans	5/21/12
A-402	Enlarged Toilet Plans	5/21/12
A-403	Enlarged Toilet Plans	5/21/12
A-404	Enlarged Toilet Plans	5/21/12
A-405	Enlarged Toilet Plans	5/21/12
A-406	Toilet Room Elevations	5/21/12
A-407	Toilet Room Elevations	5/21/12
A-408	Toilet Room Elevations	5/21/12
A-410	Enlarged Plan- Administration Offices	5/21/12
A-411	Enlarged Floor Plans – 1st Floor Area B	5/21/12
A-412	Enlarged Floor Plans – Guidance and Special Needs	5/21/12
A-413	Enlarged Plans – Science Rooms	5/21/12
A-414	Enlarged Plans – Typical Biology & Chemistry Rooms	5/21/12
A-415	Enlarged Plans – Shared Science & 9th Grade Science Classrooms	5/21/12
A-416	Enlarged Plans & Details – Science	5/21/12
A-417	Enlarged Floor Plan – Library	5/21/12
A-418	Enlarged Floor Plans – Lecture Hall	5/21/12
A-419	Enlarged Plans –Rotunda	5/21/12
A-420	Enlarged Plan – Alternate	5/21/12
A-430	Court Striping Plan – Main Gym	5/21/12
A-431	Court Striping Plan – Auxiliary Gym	5/21/12
A-441	Exterior Stair & Ramp Plan & Sections	5/21/12
A-442	Ramp-Stair Plans & Sections	5/21/12
A-451	Enlarged Floor Plans & Sections – Stair No. 1	5/21/12
A-452	Enlarged Floor Plans & Sections – Stair No. 2	5/21/12

A-453	Enlarged Floor Plans & Sections – Stair No. 3	5/21/12
A-454	Enlarged Floor Plans & Sections – Stair No. 4	5/21/12
A-455	Stair Plans & Sections	5/21/12
A-456	Stair Plans & Sections	5/21/12
A-457	Equipment Platform Access – Plans and Sections	5/21/12
A-458	Stair & Railing Details	5/21/12
A-459	Railing Schedule	5/21/12
A-461	Enlarged Plans & Sections – Elevators No. 1 & No. 2	5/21/12
A-470	Interior Elevations – 1st Fl Area A & C	5/21/12
A-471	Interior Elevations – 1st Fl Area B	5/21/12
A-472	Interior Elevations – 1st Fl Area C, 2nd Fl Area A, 3rd Fl Area A	5/21/12
A-473	Interior Elevations – Rotunda	5/21/12
A-474	Interior Elevations – Lecture Hall	5/21/12
A-475	Interior Elevations – Library	5/21/12
A-476	Interior Elevations – Library	5/21/12
A-480	Interior Elevations – Areas D, E & F	5/21/12
A-481a	Interior Elevations	5/21/12
A-481b	Interior Elevations	5/21/12
A-482a	Interior Elevations	5/21/12
A-482b	Interior Elevations	5/21/12
A-483a	Interior Elevations	5/21/12
A-483b	Interior Elevations	5/21/12
A-484a	Interior Elevations	5/21/12
A-484b	Interior Elevations	5/21/12
A-485a	Interior Elevations	5/21/12
A-486a	Interior Elevations	5/21/12
A-486b	Interior Elevations	5/21/12
A-490	Interior Elevations – Areas F & H	5/21/12
A-491	Interior Elevations – Area H	5/21/12
A-492	Interior Elevations – Main Gym	5/21/12
A-493	Interior Elevations – Auxiliary Gym	5/21/12
A-494	Casework Details	5/21/12
A-495	Casework Details	5/21/12
A-496	Casework Details	5/21/12

Bid Package E - FOR REFERENCE ONLY

C-001C	Overall Layout	1/24/12
C-101C	Existing Conditions Plan	1/24/12
C-102C	Existing Conditions Plan	1/24/12
C-500C	Erosion & Sediment Control Key Sheet	1/24/12
C-501C	Erosion & Sediment Control Plan	1/24/12
C-502C	Erosion & Sediment Control Plan	1/24/12
C-503C	Erosion & Sediment Control Plan	1/24/12
C-505C	Erosion & Sediment Control Plan	1/24/12
C-507C	Stormwater Management Pond 1 Details	1/24/12
C-508C	Stormwater Management Pond 2 Details	1/24/12
C-509C	Erosion & Sediment Control Details	1/24/12
C-510C	Erosion & Sediment Control Notes and Details	1/24/12

C-511C	Erosion & Sediment Control Phasing Plan	1/24/12
C-601F	Signage and Striping Plan	2/24/12
C-602F	Entrance Plan	2/24/12
C-603F	Signage and Striping Plan	2/24/12
C-604F	Entrance Plan	2/24/12
C-605F	Entrance Plan Notes & Details	2/24/12
C-606F	Multi-use Path Grading Plan	2/24/12
C-703F	Road Profile	2/24/12
C-903C	Construction Details	1/24/12
CC11	Entrance and Frontage Road Improvements Index Plan	11/16/11
CC12	Delaware Route 8 Existing Conditions Plan	12/16/10
CC13	Frontage Road & Entrance Typical Sections	12/22/11
CC14	Frontage Road Improvement – Sections 1	4/19/11
CC15	Frontage Road Improvement – Sections 2	4/19/11
CC16	Frontage road Improvements Plan	12/22/11
CC17	Frontage Road Improvements Grading Plan	12/22/11
CC18	Frontage Road & Entrance Storm Drain Profiles	12/22/11
CC19	Frontage Road & Entrance Construction Details 1	12/22/11
CC20	Frontage Road & Entrance Construction Details 2	2/2/12
CC21	Frontage Road Improvement E & S Control Plan	12/22/11
CC22	Frontage Road Improvement E & S Details 1	9/15/11
CC23	Frontage Road Improvement E & S Details 2	4/19/11
CC24	Phase 1 Traffic Control Plan	11/1/11
CC25	Phase 2 Traffic Control Plan	12/22/11
CC26	Phase 3 Traffic Control Plan	12/22/11
CC27	Phase 4 Traffic Control Plan	9/15/11
CC28	Utility Relocation Plan	12/22/11
CC29	Frontage Road & Entrance Signage & Striping Plan	2/15/12
CC30	Road Improvement Plan View Continuations	4/19/11
CC31	Entrance Sight Triangle Plan	4/19/11

Bid Package D – Volume III - FOR REFERENCE ONLY

G-001.D	Volume III - Bid Pac D - Cover Sheet	12/19/11
G-002.D	Volume III - Bid Pac D - Drawing List	12/19/11
G-003.D	Volume III - Bid Pac D - Drawing List	12/19/11
M-111	First Floor Plan - Part A (Kccs, Special Needs & Guidance)	12/19/11
M-112	First Floor Plan - Part B (Administration, Health & Wellness)	12/19/11
M-113	First Floor Plan - Part C (9th Grade Academy)	12/19/11
M-114	First Floor Plan - Part D (Student Dining)	12/19/11
M-115	First Floor Plan - Part E (Theater)	12/19/11
M-115a	First Floor Plan - Part E (Theater) – Alternate	12/19/11
M-116	First Floor Plan - Part F (Culinary Arts)	12/19/11
M-117	First Floor Plan - Part G (Gymnasium)	12/19/11
M-118	First Floor Plan - Part H (Auxiliary Gymnasium)	12/19/11
M-118a	First Floor Plan - Part H (Auxiliary Gymnasium) – Alternate	12/19/11
M-119	Sections – HVAC	12/19/11
M-121	Second Floor Plan - Part A (English Academy)	12/19/11
M-122	Second Floor Plan - Part B (Media Center)	12/19/11

M-123	Second Floor Plan - Part C (History & Social Studies)	12/19/11
M-124	Second Floor Plan - Part D - (Student Dining)	12/19/11
M-125	Second Floor Plan - Part E (Upper Theater)	12/19/11
M-126	Second Floor Plan - Part F (Running Track)	12/19/11
M-127	Second Floor Plan - Part H (Auxilary Gymnasium)	12/19/11
M-128	Second Floor Plan - Part H (Auxilary Gyminasium)	12/19/11
M-129	Second Floor Plan - Part J (Main Street)	12/19/11
M-131	Third Floor Plan - Part A (Math Academy)	12/19/11
M-132	Third Floor Plan - Part B (Science)	12/19/11
M-133	Third Floor Plan - Part C (Science Labs)	12/19/11
M-141	Mezzanine Floor Plan - Part A	12/19/11
M-143	Mezzanine Floor Plan - Part C	12/19/11
M-144	Roof Plan - Area D (Student Dining)	12/19/11
M-146	Roof Plan - Area F (Culinary Arts)	12/19/11
M-148	Roof Plan - Area H (Auxiliary Gymnasium)	12/19/11
M-149	Roof Plan - Area J (Main Street)	12/19/11
M-201	Part Plans - HVAC - Main Kitchen / Culinary Arts Kitchen	12/19/11
M-202	HVAC - Main Mechanical Room	12/19/11
M-203	Part Plans – HVAC	12/19/11
M-204	Part Plans – HVAC	12/19/11
M-205	Part Plans – HVAC	12/19/11
M-301	Details – HVAC	12/19/11
M-302	Details – HVAC	12/19/11
M-303	Details – HVAC	12/19/11
M-304	Details – HVAC	12/19/11
M-305	Details – HVAC	12/19/11
M-306	Details – HVAC	12/19/11
M-307	Details – HVAC	12/19/11
M-308	Details – HVAC	12/19/11
M-309	Details – HVAC	12/19/11
M-310	ATC Diagrams – HVAC	12/19/11
M-311	ATC Diagrams – HVAC	12/19/11
M-312	ATC Diagrams – HVAC	12/19/11
M-401	Schedules – HVAC	12/19/11
M-402	Schedules – HVAC	12/19/11
M-403	Schedules – HVAC	12/19/11
M-404	Schedules – HVAC	12/19/11
M-405	Schedules – HVAC	12/19/11
M-406	Schedules – HVAC	12/19/11
M-501	Sections – HVAC	12/19/11
M-502	Sections – HVAC	12/19/11
M-503	First Floor Plan - Part J - (Main Street)	12/19/11
M-504	Sections – HVAC	12/19/11
M-505	Sections – HVAC	12/19/11
M-506	Sections – HVAC	12/19/11
M-507	Sections – HVAC	12/19/11
M-508	Sections – HVAC	12/19/11
M-509	Sections – HVAC	12/19/11
M-510	Sections – HVAC	12/19/11

M-511	Sections – HVAC	12/19/11
E-100	Electrical Notes, Schedules, And Legend	12/19/11
E-101	Electrical Site Plan - Primary Electric Service	12/19/11
E-111	First Floor Power Plan - Part C - (9th Grade Academy)	12/19/11
E-112	First Floor Power Plan - Part B - (Administration, Guidance, Health & Wellness Center)	12/19/11
E-113	First Floor Power Plan - Part A - (Kcss, Special Needs & Partial Admin)	12/19/11
E-114	First Floor Power Plan - Part D - (Student Dining)	12/19/11
E-115	First Floor Power Plan - Part E/K - (Theater/Service Yard)	12/19/11
E-116	First Floor Power Plan - Part F - (Culinary Arts)	12/19/11
E-117	First Floor Power Plan - Part G - (Athletics)	12/19/11
E-118	First Floor Power Plan - Part H - (Career Technology & Physical Education)	12/19/11
E-119	First Floor Power Plan - Part J - (Main Street)	12/19/11
E-120a	First Floor Power Plan - Part D - (Kitchen)	12/19/11
E-120b	First Floor Power Plan - Part D - (Kitchen Schedules)	12/19/11
E-120c	First Floor Power Plan - Part D - (Kitchen)	12/19/11
E-121	Second Floor Power Plan - Part C - (History & Social Studies)	12/19/11
E-122	Second Floor Power Plan - Part B - (Media Center)	12/19/11
E-123	Second Floor Power Plan - Part A - (English Academy)	12/19/11
E-124	Second Floor Power Plan - Part E/H - (Mechanical Mezzanine)	12/19/11
E-127	Third Floor Power Plan - Part C - (Science Labs)	12/19/11
E-128	Third Floor Power Plan - Part B - (Science)	12/19/11
E-129	Third Floor Power Plan - Part A - (Math Academy)	12/19/11
E-130	Attic Power Plan - Part C	12/19/11
E-132	Attic Power Plan - Part A	12/19/11
E-133	First Floor Power Plan - Parts E/H - (Alternates)	12/19/11
E-211	First Floor Lighting Plan - Part C - (9th Grade Academy)	12/19/11
E-212	First Floor Lighting Plan - Part B - (Administration, Guidance, Health & Wellness Center)	12/19/11
E-213	First Floor Lighting Plan - Part A - (Kcss, Special Needs & Partial Admin)	12/19/11
E-214	First Floor Lighting Plan - Part D - (Student Dining)	12/19/11
E-215	First Floor Lighting Plan - Part E/K - (Theater/Service Yard)	12/19/11
E-216	First Floor Lighting Plan - Part F - (Culinary And Visual Arts)	12/19/11
E-217	First Floor Lighting Plan - Part G - (Athletics)	12/19/11
E-218	First Floor Lighting Plan - Part H - (Career Technology & Physical Education)	12/19/11
E-219	First Floor Lighting Plan - Part J - (Main Street)	12/19/11
E-221	Second Floor Lighting Plan - Part C - (History & Social Studies)	12/19/11
E-222	Second Floor Lighting Plan - Part B - (Media Center)	12/19/11
E-223	Second Floor Lighting Plan - Part A - (English Academy)	12/19/11
E-224	Second Floor Lighting Plan - Part E/H - (Mechanical Mezzanine)	12/19/11
E-227	Third Floor Lighting Plan - Part C - (Science Labs)	12/19/11
E-228	Third Floor Lighting Plan - Part B - (Science)	12/19/11
E-229	Third Floor Lighting Plan - Part A - (Math Academy)	12/19/11
E-230	Attic Lighting Plan - Part C	12/19/11
E-231	Attic Lighting Plan - Part A	12/19/11
E-232	First Floor Lighting Plan - Part E/H - (Alternates)	12/19/11
E-600	Electrical Schedules, Diagrams & Details	12/19/11
E-601	Electrical Single Line Diagram	12/19/11
E-602	Lighting Fixture Schedule - (Part 1)	12/19/11
E-603	Lighting Fixture Schedule - (Part 2)	12/19/11
E-604	Lighting Fixture Schedule - (Part 3)	12/19/11

E-605	Panel Schedules	12/19/11
E-606	Panel Schedules	12/19/11
E-607	Panel Schedules	12/19/11
E-608	Panel Schedules	12/19/11
E-609	Panel Schedules	12/19/11
E-610	Panel Schedules	12/19/11
E-611	Panel Schedules	12/19/11
E-612	Lighting Control Diagrams	12/19/11
E-700	First Floor - Part E - Stage Lighting Systems/Device Locations Plan	12/19/11
E-701	Catwalk Level - Part E - Stage Lighting Systems/Device Locations Plan	12/19/11
E-702	Catwalk Level - Part E - Stage/House Lighting Systems & Hoist Systems	12/19/11
E-703	First Floor - Part E - Av Device Locations Plan	12/19/11
E-704	Catwalk Level - Part E - Av Device Locations Plan	12/19/11
E-705	First Floor - Part E - Stage/House Lighting Systems	12/19/11
T-000	Technology Notes And Symbols	12/19/11
T-001	Technology Site Plan (For Reference Only)	12/19/11
T-101	Technology Overall Floor Plans	12/19/11
T-111	Technology First Floor Part A	12/19/11
T-112	Technology First Floor Part B	12/19/11
T-113	Technology First Floor Part C	12/19/11
T-114	Technology First Floor Part D	12/19/11
T-115	Technology First Floor Part E	12/19/11
T-115a	Technology First Floor Part E Alternate	12/19/11
T-116	Technology First Floor Part F	12/19/11
T-117	Technology First Floor Part G	12/19/11
T-118	Technology First Floor Part H	12/19/11
T-118a	Technology First Floor Part H Alternate	12/19/11
T-119	Technology First Floor Part J	12/19/11
T-120	Technology First Floor Service Yard	12/19/11
T-121	Technology Second Floor Part A	12/19/11
T-122	Technology Second Floor Part B	12/19/11
T-123	Technology Second Floor Part C	12/19/11
T-124	Technology Second Floor Parts D & E	12/19/11
T-125	Technology Second Floor Part G	12/19/11
T-126	Technology Second Floor Part H	12/19/11
T-131	Technology Third Floor Part A	12/19/11
T-132	Technology Third Floor Part B	12/19/11
T-133	Technology Third Floor Part C	12/19/11
T-400	Technology Main Telecom Room And Field House Telecom	12/19/11
T-401	Technology Room And Rack Details	12/19/11
T-402	Technology Pathway, Conduit & Faceplates I	12/19/11
T-403	Technology Pathway, Conduit & Faceplates II	12/19/11
T-404	Technology Catv System Details (For Reference Only)	12/19/11
T-405	Technology Intercom And Clock Details (For Reference Only)	12/19/11
T-406	Technology Access & Intrusion System Details (For Reference Only)	12/19/11
T-407	Technology Cctv System Details (For Reference Only)	12/19/11
T-408	Technology A/V System Details I (For Reference Only)	12/19/11
T-409	Technology A/V System Details Ii (For Reference Only)	12/19/11
Tf-111	Technology Fieldhouse Plans (For Reference Only)	12/19/11

Bid Package D – Volume II - FOR REFERENCE ONLY

Ga-101	Code Summary Plan - First Floor	12/19/11
Ga-102	Code Summary Plan - Second Floor And Third Floor	12/19/11
Ga-103	Code Review Summary	12/19/11
G-001.D	Volume II - Bid Pac D - Cover Sheet	12/19/11
G-002.D	Volume II - Bid Pac D - Drawing List	12/19/11
G-003.D	Volume II - Bid Pac D - Drawing List	12/19/11
A-001	Partition Types	12/19/11
A-002	Exterior Assembly & Interior Partition Schedule	12/19/11
A-101	Overall Floor Plan - First Floor	12/19/11
A-102	Overall Floor Plan - Second Floor	12/19/11
A-103	Overall Floor Plans - Third Floor And Equipment Platform Level	12/19/11
A-104	Overall Plan – Roof	12/19/11
A-111	First Floor Plan - Area A (Special Needs, Kccs & Partial Admin)	12/19/11
A-112	First Floor Plan - Area B (Administration, Guidance, Health & Wellness Center)	12/19/11
A-113	First Floor Plan - Area C (Ninth Grade Academy)	12/19/11
A-114	First Floor Plan - Part D (Student Dining)	12/19/11
A-115	First Floor Plan - Part E (Theater)	12/19/11
A-115a	First Floor Plan - Part E - Alternate 2bpc (Theater)	12/19/11
A-116	First Floor Plan - Area F (Culinary And Visual Arts)	12/19/11
A-117	First Floor Plan - Area G (Athletics)	12/19/11
A-118	First Floor Plan - Area H (Career Technology And Physical Education)	12/19/11
A-118a	Add Alternate A-3bpc - Area "H"	12/19/11
A-119	First Floor Plan - Part J (Main Street)	12/19/11
A-120	First Floor Slab Plan - Part K (Service Yard)	12/19/11
A-121	Second Floor Plan - Area A (English And World Languages Academies)	12/19/11
A-122	Second Floor Plan - Area B	12/19/11
A-123 S	Second Floor Plan - Area C (History / Social Sciences Academies)	12/19/11
A-124	Second Floor Plan - Part D (Equipment Platform)	12/19/11
A-125	Second Floor Plan - Part E (Theater)	12/19/11
A-126	Second Floor Plan - Part E (Catwalk Level)	12/19/11
A-127	Upper Level Floor Plans - Areas G & H	12/19/11
A-131	Third Floor Plan - Area A (Math Academy)	12/19/11
A-132	Third Floor Plan - Area B (Lecture Hall & Science)	12/19/11
A-133	Third Floor Plan - Area C (Science Academy)	12/19/11
A-134	Upper Level Floor Plan (Equipment Platform) - Area A	12/19/11
A-135	Upper Level Floor Plan (Equipment Platform) - Area C	12/19/11
A-141	Partial Roof Plan - Area A	12/19/11
A-142	Partial Roof Plan - Area B	12/19/11
A-143	Partial Roof Plan - Area C	12/19/11
A-144	Partial Roof Plan - Area D	12/19/11
A-145	Partial Roof Plan - Area E	12/19/11
A-145a	Partial Roof Plan - Auditorium & Performing Arts – Alternate	12/19/11
A-146	Partial Roof Plan - Area F	12/19/11
A-147	Partial Roof Plan - Area G	12/19/11
A-148	Partial Roof Plan - Area H	12/19/11

A-148a	Partial Roof Plan - Alternate 3-BPD	12/19/11
A-149	Roof Plan – Mainstreet	12/19/11
A-151	Partial Roof Plans - Exterior Canopies	12/19/11
A-161	First Floor RCP – Overall	12/19/11
A-162	Second Floor RCP – Overall	12/19/11
A-163	Third Floor RCP – Overall	12/19/11
A-171	First Floor RCP - Area A (Kccs, Special Needs & Partial Administration)	12/19/11
A-172	First Floor RCP - Area B (Administration, Guidance, Health & Wellness Center)	12/19/11
A-173	First Floor RCP-Area C (9th Grade Academy)	12/19/11
A-174	First Floor RCP - Part D (Student Dining)	12/19/11
A-175	First Floor RCP - Part E (Theater)	12/19/11
A-175a	First Floor RCP - Part E (Theater) – Alternate	12/19/11
A-176	First Floor RCP-Area F (Culinary & Visual Arts)	12/19/11
A-177	First Floor RCP-Area G (Athletics)	12/19/11
A-178	First Floor RCP - Part H (Auxillary Gymnasium)	12/19/11
A-179	First Floor RCP - Part I (Main Street)	12/19/11
A-181	Second Floor RCP - Area A (English Academy)	12/19/11
A-182	Second Floor RCP - Area B	12/19/11
A-183	Second Floor RCP - Area C (History & Social Studies)	12/19/11
A-184	Second Floor RCP - Part D	12/19/11
A-185	Second Floor RCP - Part E (Theater)	12/19/11
A-191	Third Floor RCP - Area A (Math Academy)	12/19/11
A-192	Third Floor RCP - Area B	12/19/11
A-193	Third Floor RCP - Area C (Science Academy)	12/19/11
A-194	Equipment Platform RCP	12/19/11
A-201	Exterior Elevations – Overall	12/19/11
A-202	Exterior Elevations – Overall	12/19/11
A-211	Partial Exterior Elevations - Academic Building	12/19/11
A-212	Partial Exterior Elevations-Area A & B	12/19/11
A-213	Partial Exterior Elevations-Area A & B	12/19/11
A-214	Partial Exterior Elevations-Area B & C	12/19/11
A-215	Enlarged Elevations	12/19/11
A-216	Enlarged Elevations	12/19/11
A-217	Enlarged Elevations	12/19/11
A-218	Enlarged Elevations	12/19/11
A-219	Partial Exterior Elevations - Areas F, G & H	12/19/11
A-220	Partial Exterior Elevations - Area H	12/19/11
A-301	Building Sections	12/19/11
A-302	Building Sections	12/19/11
A-304	Building Sections	12/19/11
A-311	Partial Building Sections	12/19/11
A-312	Partial Building Section	12/19/11
A-313	Building Sections	12/19/11
A-314	Building Sections	12/19/11
A-315	Building Sections	12/19/11
A-318	Partial Building Sections	12/19/11
A-331	Wall Sections	12/19/11
A-332	Wall Sections	12/19/11
A-333	Wall Sections	12/19/11

A-334	Wall Sections	12/19/11
A-335	Wall Sections	12/19/11
A-336	Wall Sections	12/19/11
A-337	Wall Sections	12/19/11
A-338	Wall Sections	12/19/11
A-339	Wall Sections	12/19/11
A-340	Wall Sections	12/19/11
A-341	Wall Sections	12/19/11
A-342	Wall Sections – Rotunda	12/19/11
A-343	Wall Sections – Library	12/19/11
A-344	Wall Sections	12/19/11
A-345	Sections - Entrance Canopy	12/19/11
A-346	Wall Sections	12/19/11
A-347	Wall Sections	12/19/11
A-348	Wall Sections	12/19/11
A-349	Wall Sections	12/19/11
A-350	Wall Sections	12/19/11
A-351	Wall Sections	12/19/11
A-352	Wall Sections	12/19/11
A-353	Wall Sections	12/19/11
A-354	Wall Sections	12/19/11
A-355	Wall Sections	12/19/11
A-356	Wall Sections	12/19/11
A-357	Wall Sections - Main Gym	12/19/11
A-358	Wall Sections	12/19/11
A-359	Wall Sections / Canopy Details	12/19/11
A-360	Wall Sections	12/19/11
A-361	Wall Sections-Area H	12/19/11
A-362	Wall Sections – Pilaster	12/19/11
A-363	Wall Sections	12/19/11
A-364	Wall Sections	12/19/11
A-365	Wall Sections	12/19/11
A-366	Wall Sections - Alternate 3-BPD	12/19/11
A-401	Enlarged Toilet Plans	12/19/11
A-402	Enlarged Toilet Plans	12/19/11
A-403	Enlarged Toilet Plans	12/19/11
A-404	Enlarged Toilet Plans	12/19/11
A-421	Enlarged Plan - Administration Offices	12/19/11
A-422	Enlarged Floor Plans	12/19/11
A-423	Enlarged Floor Plans - Guidance And Special Needs	12/19/11
A-424	Enlarged Plans - Typical Science Rooms	12/19/11
A-425	Enlarged Plans - Typical Classrooms	12/19/11
A-426	Enlarged Plans - 3d Studio, Animal, And Plant Sciences	12/19/11
A-427	Enlarged Floor Plan – Library	12/19/11
A-428	Enlarged Floor Plans	12/19/11
A-429	Enlarged Plans – Rotunda	12/19/11
A-431	Enlarged Plan	12/19/11
A-432	Enlarged Plan	12/19/11
A-433	Enlarged Plan – Alternate	12/19/11

A-441	Exterior Stair & Ramp Plan & Sections	12/19/11
A-442	Ramp-Stair Plans & Sections	12/19/11
A-451	Enlarged Floor Plans & Sections - Stair No.1	12/19/11
A-452	Enlarged Floor Plans & Sections - Stair No.2	12/19/11
A-453	Enlarged Floor Plans & Sections - Stair No.3	12/19/11
A-454	Enlarged Floor Plans & Sections - Stair No.4	12/19/11
A-455	Stair Plans & Sections	12/19/11
A-456	Stair Plans & Sections	12/19/11
A-457	Equipment Platform Access - Plans And Sections	12/19/11
A-458	Stair & Railing Details	12/19/11
A-461	Enlarged Plans & Sections - Elevators No. 1 & No. 2	12/19/11
A-471a	Interior Elevations	12/19/11
A-471b	Interior Elevations	12/19/11
A-472a	Interior Elevations	12/19/11
A-472b	Interior Elevations	12/19/11
A-473a	Interior Elevations	12/19/11
A-473b	Interior Elevations	12/19/11
A-481	Interior Elevations	12/19/11
A-482	Interior Elevations – Library	12/19/11
A-485	Interior Elevations – Library	12/19/11
A-511	Plan Details - Academic Building	12/19/11
A-512	Plan Details - Academic Building	12/19/11
A-513	Plan Details - Academic Building	12/19/11
A-521	Interior Plan Details	12/19/11
A-522	Interior Plan Details	12/19/11
A-523	Interior Plan Details	12/19/11
A-524	Interior Plan Details	12/19/11
A-525	Interior Plan Details	12/19/11
A-526	Interior Plan Details	12/19/11
A-531	Plan Details - Area F	12/19/11
A-532	Area G Plan Details	12/19/11
A-533	Area F Plan Details	12/19/11
A-534	Plan Details Area H	12/19/11
A-535	Plan Details	12/19/11
A-541	Foundation & Slab Details	12/19/11
A-542	Foundation & Slab Details	12/19/11
A-544	Foundation & Slab Details	12/19/11
A-545	Foundation & Slab Details	12/19/11
A-546	Foundation & Slab Details	12/19/11
A-547	Foundation & Slab Details	12/19/11
A-548	Foundation & Slab Details	12/19/11
A-553	Vertical Details - Areas A, B, C	12/19/11
A-561	Section Details	12/19/11
A-562	Section Details	12/19/11
A-563	Section Details	12/19/11
A-564	Section Details	12/19/11
A-565	Section Details	12/19/11
A-566	Casework Details	12/19/11
A-570a	Vertical Details - Areas F, G, H	12/19/11

A-570b	Vertical Details - Areas F, G, H	12/19/11
A-570c	Vertical Details - Areas F, G, H	12/19/11
A-571c	Vertical Details - Areas F, G, H	12/19/11
A-591	Roof Details	12/19/11
A-592	Roof Details	12/19/11
A-601	Door Schedule	12/19/11
A-602	Door Schedule	12/19/11
A-603	Door Schedule	12/19/11
A-604	Door Schedule	12/19/11
A-605	Door & Frame Types	12/19/11
A-606	Door & Frame Types	12/19/11
A-608	Door Schedule	12/19/11
A-610	Window Schedule	12/19/11
A-611	Window & Louver Schedule	12/19/11
A-612	Window Schedule	12/19/11
A-613	Window Details	12/19/11
A-614	Window Details	12/19/11
A-615	Window Details	12/19/11
A-620	Storefront Schedule	12/19/11
A-621	Storefront Schedule	12/19/11
A-622	Window Schedule	12/19/11
Te-101	Concert Shell System Plan	12/19/11
Te-102	Concert Shell System Typical Section	12/19/11
Tl-101	Stage Lighting System Light Plot	12/19/11
Tl-102	Stage Lighting System Distribution	12/19/11
Tl-103	Stage Lighting System Oneline	12/19/11
Tl-104	Stage Lighting Systems Dance Room	12/19/11
Tl-105	CCTV Studio Lighting System	12/19/11
Tr-101	Stage Rigging Systems Batten And Drapery Plan	12/19/11
Tr-102	Stage Rigging Systems Typical Manual Counterweight	12/19/11
Tr-102a	Stage Rigging Systems Typical Traveler Rigging Elevation	12/19/11
Tr-103	Stage Rigging Systems Typical Motorized Assist	12/19/11
Tr-104	Stage Rigging Systems Typical Section And Schedules	12/19/11
Tr-105	Stage Rigging And Draperies Schedules	12/19/11
Tr-106	Rehearsal Room Pipe Grid, Tracks, And Draperies	12/19/11
Tr-107	Tv & Photo Studio Pipe Grid, Tracks, And Draperies	12/19/11
Ts-101	Auditorium Av System Sound Oneline	12/19/11
Ts-102	Auditorium Av System Sound Details	12/19/11
Ts-103	Auditorium Av System Cluster Details	12/19/11
Ts-104	Auditorium Av System Video System	12/19/11

<u>Bid Package D – Volume I - FOR REFERENCE ONLY</u>

BID PAC D - Cover Sheet		12/19/11
G-002.D	Volume I - Bid Pac D - Drawing List	12/19/11
G-003.D	Volume I - Bid Pac D - Drawing List	12/19/11
S-001	Structural Notes	12/19/11
S-002	Special Inspection Notes Cold-Formed Wall Sched. Lintel Schedule	12/19/11
S-101	Overall Foundation Plan	12/19/11

S-101a	Foundation Plan - Part A (Administration, Guidance, Health & Wellness Center)		12/19/11
S-101b	Foundation Plan - Part B (Administration, Guidance, Health & Wellness Center)		12/19/11
S-101c	Foundation Plan - Part C (9th Grade Academy)	12/19/11	
S-101d	Foundation Plan - Part D (Student Dining)	12/19/11	
S-101e	Foundation Plan - Part E (Theater)	12/19/11	
S-101f	Foundation Plan - Part F & J (Culinary Arts)	12/19/11	
S-101g	Foundation Plan - Part G (Gymnasium)	12/19/11	
S-101h	Foundation Plan - Part H (Auxiliary Gymnasium)	12/19/11	
S-101k	Foundation Plan - Part K (Service Yard)	12/19/11	
S-102	Overall Second Floor Framing Plan	12/19/11	
S-102a	Second Floor Framing Plan - Part A (English Academy)	12/19/11	
S-102b	Second Floor Framing Plan - Part B (Media Center)	12/19/11	
S-102c	Second Floor Framing Plan - Part C (History & Social Studies)	12/19/11	
S-102d	Equipment Platform Floor & Low Roof Framing Plan – Part D (Student Dining)		12/19/11
S-102e	Theater Seating & Low Roof Framing Plan - Part E (Theater)		12/19/11
S-102f	Low Roof Framing Plan - Part F & J (Culinary Arts)		12/19/11
S-102g	Low Roof Framing Plan - Part G (Gymnasium)		12/19/11
S-102h	Equpment Platform Floor & Low Roof Framing Plan – Part H (Auxilary Gymnasium)		12/19/11
S-103	Overall Third Floor Framing Plan		12/19/11
S-103a	Third Floor Framing Plan - Part A (Math Academy)		12/19/11
S-103b	Third Floor Framing Plan - Part B (Science)		12/19/11
S-103c	Third Floor Framing Plan - Part C (Science Labs)		12/19/11
S-103d	Equipment Platform Roof Framing Plan - Part D (Student Dining)		12/19/11
S-103e	Main Street Roof & Catwalk Framing Plan - Part E & J		12/19/11
S-103h	Roof Framing Plan - Part H (Auxiliary Gymnasium)		12/19/11
S-104	Overall Roof Framing Plan		12/19/11
S-104a	Loft & Roof Framing Plan - Part A (West Academic Wing)		12/19/11
S-104b	Loft & Roof Framing Plan - Part B (Central Academic Wing)		12/19/11
S-104c	Loft & Roof Framing Plan - Part C (Eastern Academic Wing)		12/19/11
S-104e	Roof Framing Plan - Part E (Theater)		12/19/11
S-104g	Roof Framing Plan - Part G (Gymnasium)		12/19/11
S-105	Overall High Roof Framing Plan		12/19/11
S-105a	High Roof Framing Plan - Part A (West Academic Wing)		12/19/11
S-105b	High Roof Framing Plan - Part B (Central Academic Wing)		12/19/11
S-105c	High Roof Framing Plan - Part C (Eastern Academic Wing)		12/19/11
S-106e	Alternate Plans - Part E (Alternate 2-Bpc)		12/19/11
S-106h	Alternate Plans - Part H (Alternate 3-Bpc)		12/19/11
S-201	Foundation Details		12/19/11
S-202	Framing Details		12/19/11
S-203	Auditorium Details		12/19/11
S-204	Academic Details		12/19/11
S-205	Framing Details		12/19/11
S-206	Framing Details		12/19/11
S-207	Typical Framing Sections & Details		12/19/11
S-208	Typical Framing Sections & Details		12/19/11
S-301	Typical Foundation Sections & Details		12/19/11
S-302	Typical Framing Sections & Details		12/19/11
S-401	Truss & Joist Elevations		12/19/11
S-402	Truss, Joist, Pier & Base Plate Details		12/19/11

S-403	Partial Framing Plans	12/19/11
S-404	Framing Elevations	

Bid Package C-1-For Reference Only

G-001.C-1	Cover Sheet	11/7/11
G-002.C-1	Drawing List	11/7/11
A-114	First Floor Plan - Part D (Student Dining)	11/7/11
A-115	First Floor Plan - Part E (Theater)	11/7/11
P-111s	First Floor Plan - Part A (Kccs, Special Needs & Guidance)	11/7/11
P-112s	First Floor Plan - Part B (Administration, Health & Wellness)	11/7/11
P-113s	First Floor Plan - Part C (9th Grade Academy)	11/7/11
P-114s	First Floor Plan - Part D (Student Dining)	11/7/11
P-115a-S	First Floor Plan - Part E - Alternate 2bpc (Theater)	11/7/11
P-115s	First Floor Plan - Part E (Theater)	11/7/11
P-116s	First Floor Plan - Part F (Culinary Arts)	11/7/11
P-117s	First Floor Plan - Part G (Gymnasium)	11/7/11
P-118a-S	First Floor Plan - Part H - Alternate 3bpc (Auxiliary Gymnasium)	11/7/11
P-118s	First Floor Plan - Part H (Auxiliary Gymnasium)	11/7/11
P-119s	First Floor Plan - Part J - (Main Street)	11/7/11
P-201	Part Plans - Kitchen/Culinary Arts Kitchen	11/7/11
P-202	Part Plans - Plumbing - Mechanical Room	11/7/11
P-203	Part Plans – Plumbing	11/7/11
P-204	Part Plans – Plumbing	11/7/11
P-205	Part Plans – Plumbing	11/7/11
P-301	Details – Plumbing	11/7/11
P-401	Schedules – Plumbing	11/7/11
P-501	Sanitary Risers – Plumbing	11/7/11
P-502	Sanitary Risers – Plumbing	11/7/11
P-503	Sanitary Risers – Plumbing	11/7/11
E-100	Electrical Notes, Schedules, And Legend	11/7/11
E-101	Electrical Site Plan - Parts 1 & 2 - Underground Conduit System	11/7/11
E-102	Electrical Site Plan - Part 3 - Underground Conduit System	11/7/11
E-103	Electrical Site Details	11/7/11
E-104	Dover Electric Utility Drawing	11/7/11
E-105	Electrical Site Plan Underground Conduit System – Field House Alternate	11/7/11
E-111	First Floor Power Plan - Part C - (9th Grade Academy)	11/7/11
E-112	First Floor Power Plan - Part B - (Administration, Guidance, Health & Wellness Center)	11/7/11
E-113	First Floor Power Plan - Part A - (Kcss, Special Needs & Partial Admin)	11/7/11
E-114	First Floor Power Plan - Part D - (Student Dining)	11/7/11
E-115	First Floor Power Plan - Part E/K - (Theater/Service Yard)	11/7/11
E-116	First Floor Power Plan - Part F - (Culinary Arts)	11/7/11
E-117	First Floor Power Plan - Part G - (Athletics)	11/7/11
E-118	First Floor Power Plan - Part H - (Career Technology & Physical Education)	11/7/11

Bid Package C Volume I- FOR REFERENCE ONLY

I G-001.C	Volume I - Bid Pac C - Cover Sheet	08/08/11
I G-002.C	Volume I - Bid Pac C - Drawing List	08/08/11

C-001C	Cover Sheet & Overall Layout	08/08/11
C-101C	Easting Conditions Plan	08/08/11
C-102C	Easting Conditions Plan	08/08/11
C-201C	Site, Signage, and Striping Plans	08/08/11
C-202C	Site, Signage, and Striping Plans	08/08/11
C-203C	Site, Signage, and Striping Plans	08/08/11
C-204C	Site, Signage, and Striping Plans	08/08/11
C-205C	Site, Signage, and Striping Plans	08/08/11
C-206C	Site, Signage, and Striping Plans	08/08/11
C-300C	Overall Utilities Plan & Key Sheet	08/08/11
C-301C	Utilities Plan	08/08/11
C-302C	Utilities Plan	08/08/11
C-303C	Utilities Plan	08/08/11
C-304C	Utilities Plan	08/08/11
C-305C	Utilities Plan	08/08/11
C-306C	Utilities Plan	08/08/11
C-307C	Utilities Schedules	08/08/11
C-400C	Overall Grading Plan & Key Sheet	08/08/11
C-401C	Grading Plan	08/08/11
C-402C	Grading Plan	08/08/11
C-403C	Grading Plan	08/08/11
C-404C	Grading Plan	08/08/11
C-405C	Grading Plan	08/08/11
C-406C	Grading Plan	08/08/11
C-500C	Erosion & Sediment Control Phasing Plan	08/08/11
C-501C	Erosion & Sediment Control Plan	08/08/11
C-502C	Erosion & Sediment Control Plan	08/08/11
C-503C	Erosion & Sediment Control Plan	08/08/11
C-504C	Erosion & Sediment Control Plan	08/08/11
C-505C	Erosion & Sediment Control Plan	08/08/11
C-506C	Erosion & Sediment Control Plan	08/08/11
C-507C	Stormwater Management Pond 1 Details	08/08/11
C-508C	Stormwater Management Pond 2 Details	08/08/11
C-509C	Erosion & Sediment Control Details	08/08/11
C-510C	Erosion & Sediment Control Notes & Details	08/08/11
C-901	Construction Details	08/08/11
C-902	Construction Details	08/08/11
C-903	Construction Details	08/08/11
L1.0	Overall Landscape Plan	08/08/11
L1.1	Planting Soils Layout - West	08/08/11
L1.2	Planting Soils Layout - East	08/08/11
L2.0	Hardscape Plan - West Courtyard Enlargement	08/08/11
L2.1	Hardscape Plan - East Courtyard Enlargement	08/08/11
L2.2	Hardscape Plan - Stadium Plaza Enlargement	08/08/11
L2.3	Hardscape Plan - Stadium Plaza Enlargement	08/08/11
L2.4	Landscape Plan - Visitor Entry & Concessions Enlargement	08/08/11
L2.5	Fence Type Diagram	08/08/11
L3.0	Hardscape Details	08/08/11
L3.1	Hardscape Details	08/08/11

L4.0	Landscape Plan	08/08/11
L4.1	Landscape Plan	08/08/11
L4.2	Landscape Plan	08/08/11
L4.3	Landscape Plan	08/08/11
L4.4	Landscape Plan	08/08/11
L4.5	Landscape Plan	08/08/11
L4.6	Planting Schedule & Details	08/08/11
L4.7	Irrigation Diagram - Main School Buildings and Ball Fields	08/08/11
S-001	Structural Notes	08/08/11
S-002	Special Inspection Notes	08/08/11
S-101	Overall Foundation Plan	08/08/11
S-101A	Foundation Plan - Part A (Administration, Guidance, Health & Wellness Center)	08/08/11
S-101B	Foundation Plan - Part B (Administration, Guidance, Health &Wellness Center)	08/08/11
S-101C	Foundation Plan - Part C (9th Grade Academy)	08/08/11
S-101D	Foundation Plan - Part D (Student Dining)	08/08/11
S-101E	Foundation Plan - Part E (Theater)	08/08/11
S-101F	Foundation Plan - Part F (Culinary Arts)	08/08/11
S-101G	Foundation Plan - Part G (Gymnasium)	08/08/11
S-101H	Foundation Plan - Part H (Auxiliary Gymnasium)	08/08/11
S-101K	Foundation Plan - Part K (Service Yard)	08/08/11
S-102	Overall Second Floor Framing Plan 1	08/08/11
S-102A	Second Floor Framing Plan - Part A (English Academy)	08/08/11
S-102B	Second Floor Framing Plan - Part B (Media Center)	08/08/11
S-102C	Second Floor Framing Plan - Part C (History & Social Studies)	08/08/11
S-102D	Mezzanine & Low Roof Framing Plan - Part D (Student Dining)	08/08/11
S-102E	Theater Seating, Bridge & Low Roof Framing Plan - Part E (Theater)	08/08/11
S-102F	Low Roof Framing Plan - Part F (Culinary Arts)	08/08/11
S-102G	Low Roof Framing Plan - Part G (Gymnasium)	08/08/11
S-102H	Mezzanine Floor & Low Roof Framing Plan - Part H (Auxiliary Gymnasium)	08/08/11
S-103	Overall Third Floor Framing Plan	08/08/11
S-103A	Third Floor Framing Plan - Part A (Math Academy)	08/08/11
S-103B	Third Floor Framing Plan - Part B (Science)	08/08/11
S-103C	Third Floor Framing Plan - Part C (Science Labs)	08/08/11
S-103D	Mezzanine Roof Framing Plan - Part D (Student Dining)	08/08/11
S-103E	Main Street Roof & Catwalk Framing Plan - Part E	08/08/11
S-103H	Roof Framing Plan - Part H (Auxiliary Gymnasium)	08/08/11
S-104	Overall Roof Framing Plan	08/08/11
S-104A	Loft & Roof Framing Plan - Part A (West Academic Wing)	08/08/11
S-104B	Loft & Roof Framing Plan - Part B (Central Academic Wing)	08/08/11
S-104C	Loft & Roof Framing Plan - Part C (Eastern Academic Wing)	08/08/11
S-104E	Roof Framing Plan - Part E (Theater)	08/08/11
S-104G	Roof Framing Plan - Part G (Gymnasium)	08/08/11
S-105	Overall High Roof Framing Plan	08/08/11
S-105A	High Roof Framing Plan - Part A (West Academic Wing)	08/08/11
S-105B	High Roof Framing Plan - Part B (Central Academic Wing)	08/08/11
S-105C	High Roof Framing Plan - Part C (Eastern Academic Wing)	08/08/11
S-106E	Alternate Plans - Part E (Alternate 2-Bpc)	08/08/11

S-106H	Alternate Plans - Part H (Alternate 3-Bpc)	08/08/11
S-201	Foundation Details	08/08/11
S-202	Framing Details	08/08/11
S-203	Auditorium Details	08/08/11
S-204	Academic Details	08/08/11
S-205	Framing Details	08/08/11
S-301	Typical Foundation Sections & Details	08/08/11
S-302	Typical Framing Sections & Details	08/08/11
S-401	Truss & Joist Elevations	08/08/11
S-402	Truss, Joist, Pier & Base Plate Details	08/08/11
S-403	Partial Framing Plans	08/08/11
S-404	Braced Bay Elevations	08/08/11

Bid Package C Volume II- FOR REFERENCE ONLY

G-001.C	Volume II - Bid Pac C - Cover Sheet	08/08/11
G-002.C	Volume II - Bid Pac C - Drawing List	08/08/11
A-001	Partition Types	08/08/11
A-101	First Floor Plan – Overall	08/08/11
A-102	Second Floor Plan - Overall	08/08/11
A-103	Third Floor Plan - Overall	08/08/11
A-104	Equipment Platform Plan - Overall	08/08/11
A-105	Roof Plan - Overall	08/08/11
A-111	First Floor Plan - Area A (Special Needs, Kccs & Partial Admin)	08/08/11
A-112	First Floor Plan - Area B (Administration, Guidance, Health & Wellness Center)	08/08/11
A-113	First Floor Plan - Area C (Ninth Grade Academy)	08/08/11
A-114	First Floor Plan - Part D (Student Dining)	08/08/11
A-115	First Floor Plan - Part E (Theater)	08/08/11
A-115A	First Floor Plan - Part E - Alternate (Theater)	08/08/11
A-116	First Floor Plan - Area F (Culinary And Visual Arts)	08/08/11
A-117	First Floor Plan - Area G (Athletics)	08/08/11
A-118	First Floor Plan - Area H (Career Technology And Physical Education)	08/08/11
A-118A	Add Alternate Ag - Area "H"	08/08/11
A-119	First Floor Plan - Part J (Main Street)	08/08/11
A-120	First Floor Slab Plan - Part K (Service Yard)	08/08/11
A-121	Second Floor Plan - Area A (English And World Languages Academies)	08/08/11
A-122	Second Floor Plan - Area B (Library)	08/08/11
A-123	Second Floor Plan - Area C (History / Social Sciences Academies)	08/08/11
A-124	Second Floor Plan - Part D & E (Theater / Mechanical Mezzanine)	08/08/11
A-125	Second Floor Plan - Part E (Catwalk Level)	08/08/11
A-126	Equipment Platform, Gym Window & Au Gym Window Plan	08/08/11
A-131	Third Floor Plan - Area A (Math Academy)	08/08/11
A-132	Third Floor Plan - Area B (Lecture Hall & Science)	08/08/11
A-133	Third Floor Plan - Area C (Science Academy)	08/08/11
A-134	Equipment Platform - Area A	08/08/11
A-135	Equipment Platform - Area C	08/08/11
A-141	Roof Plan - Part A (Eastern Academic Wing)	08/08/11
A-142	Roof Plan - Part B (Central Academic Wing)	08/08/11
A-143	Roof Plan - Part C (West Academic Wing)	08/08/11

A-144	Roof Plan - Part D (Student Dining)	08/08/11
A-145	Roof Plan - Part E (Theater)	08/08/11
A-145A	Roof Plan - Auditorium & Performing Arts - Alternate	08/08/11
A-146	Roof Plan - Part F (Culinary Arts)	08/08/11
A-148	Roof Plan - Part H (Axillary Gymnasium)	08/08/11
A-149	Roof Plan - Mainstreet	08/08/11
A-201	Overall Elevations	08/08/11
A-202	Overall Elevations	08/08/11
A-211	Enlarged Elevations - Academic Building	08/08/11
A-212	Enlarged Elevations - Academic Building	08/08/11
A-213	Enlarged Elevations - Academic Building	08/08/11
A-214	Enlarged Elevations - Academic Building	08/08/11
A-215	Enlarged Elevations	08/08/11
A-216	Enlarged Elevations	08/08/11
A-217	Enlarged Elevations	08/08/11
A-218	Enlarged Elevations	08/08/11
A-219	Partial Exterior Elevations - Gymnasium - South Elev.	08/08/11
A-220	Partial Exterior Elevations - Gymnasium - South Elev.	08/08/11
A-301	Building Sections - Academic Wing	08/08/11
A-302	Building Sections - Academic Wing	08/08/11
A-303	Building Sections - Main Link	08/08/11
A-304	Building Section Area "H"	08/08/11
A-305	Building Sections Thru Gym	08/08/11
A-306	Building Sections	08/08/11
A-307	Building Sections	08/08/11
A-308	Building Sections	08/08/11
A-309	Building Sections	08/08/11
A-311	Partial Building Sections	08/08/11
A-312	Partial Building Section	08/08/11
A-331	Wall Sections - Typical Classroom	08/08/11
A-332	Wall Sections	08/08/11
A-333	Wall Sections	08/08/11
A-334	Wall Sections	08/08/11
A-335	Wall Sections	08/08/11
A-336	Wall Sections	08/08/11
A-337	Wall Sections	08/08/11
A-338	Wall Sections	08/08/11
A-339	Wall Sections	08/08/11
A-340	Wall Sections	08/08/11
A-341	Wall Sections	08/08/11
A-342	Wall Sections - Rotunda	08/08/11
A-343	Wall Sections - Library	08/08/11
A-344	Wall Sections	08/08/11
A-345	Front Canopy Section	08/08/11
A-346	Wall Sections	08/08/11
A-347	Wall Sections	08/08/11
A-348	Wall Sections	08/08/11
A-349	Wall Sections	08/08/11
A-350	Wall Sections	08/08/11

A-351	Wall Sections	08/08/11
A-352	Wall Sections	08/08/11
A-354	Wall Sections Area "F" Culinary Arts Firewall	08/08/11
A-355	Wall Sections Area "G" Gym East & West & Firewall	08/08/11
A-356	Wall Sections Area "G" Firewall	08/08/11
A-357	Wall Sections Area "F" &"G" Gym Cross Section @ Half Court	08/08/11
A-358	Wall Sections Area "H"	08/08/11
A-359	Wall Sections Area "H" Entry Canopy Details	08/08/11
A-360	Wall Sections Area "H" Equipment Platform	08/08/11
A-361	Wall Sections Area "H"	08/08/11
A-362	Wall Section @ Fin W/ Stone Veneer	08/08/11
A-441	Exterior Stair & Ramp Plan & Sections	08/08/11
A-442	Ramp-Stair Plans & Sections	08/08/11
A-451	Stair Plans & Sections - Stair No.1	08/08/11
A-452	Stair Plans & Sections - Stair No.2	08/08/11
A-453	Stair Plans & Sections - Stair No.3	08/08/11
A-454	Stair Plans & Sections - Stair No.4	08/08/11
A-455	Area "A" & "C" Mechanical Platform Stair	08/08/11
A-456	Stair Plans & Sections	08/08/11
A-457	Stair Plans & Sections	08/08/11
A-458	Enlarged Plans And Sections - Stair No.6	08/08/11
A-503	Section Details	08/08/11
A-504	Section Details	08/08/11
A-505	Section Details	08/08/11
A-510	Plan Details	08/08/11
A-511	Section Details	08/08/11
A-512	Section Details	08/08/11
A-514	Foundation & Slab Details	08/08/11
A-515	Foundation & Slab Details	08/08/11
A-516	Foundation & Slab Details	08/08/11
A-519	Section Details	08/08/11
A-520	Section Details	08/08/11

Bid Package C Volume III- FOR REFERENCE ONLY

G-001.C	Volume III - Bid Pac C - Cover Sheet III	08/08/11
G-002.C	Volume III - Bid Pac C - Drawing List	08/08/11
P-111S	First Floor Plan - Part A (Kccs, Special Needs & Guidance)	08/08/11
P-112S	First Floor Plan - Part B (Administration, Health & Wellness)	08/08/11
P-113S	First Floor Plan - Part C (9th Grade Academy)	08/08/11
P-114S	First Floor Plan - Part D (Student Dining)	08/08/11
P-115S	First Floor Plan - Part E (Theater)	08/08/11
P-116S	First Floor Plan - Part F (Culinary Arts)	08/08/11
P-117S	First Floor Plan - Part G (Gymnasium)	08/08/11
P-118S	First Floor Plan - Part H (Auxiliary Gymnasium)	08/08/11
P-201	Part Plans - Kitchen/Culinary Arts Kitchen	08/08/11
P-202	Part Plans - Plumbing - Mechanical Room	08/08/11
P-203	Part Plans - Plumbing	08/08/11
P-204	Part Plans - Plumbing	08/08/11
P-205	Part Plans - Plumbing	08/08/11

P-301	Details - Plumbing	08/08/11
P-401	Schedules - Plumbing	08/08/11
P-501	Sanitary Risers - Plumbing	08/08/11
P-502	Sanitary Risers - Plumbing	08/08/11
P-503	Sanitary Risers - Plumbing	08/08/11
E-100	Electrical Notes, Schedules, And Legend	08/08/11
E-101	Electrical Site Plan - Parts 1 & 2 - Underground Conduit System	08/08/11
E-102	Electrical Site Plan - Part 3 - Underground Conduit System	08/08/11
E-103	Electrical Site Details	08/08/11
E-104	Dover Electric Utility Drawing	08/08/11
E-105	Electrical Site Plan - Field House Alternate	08/08/11
E-111	First Floor Power Plan - Part C - (9th Grade Academy)	08/08/11
E-112	First Floor Power Plan - Part B - (Administration, Guidance, Health & Wellness Center)	08/08/11
E-113	First Floor Power Plan - Part A - (Kcss, Special Needs & Partial Admin)	08/08/11
E-114	First Floor Power Plan - Part D - (Student Dining)	08/08/11
E-115	First Floor Power Plan - Part E/K - (Theater/Service Yard)	08/08/11
E-116	First Floor Power Plan - Part F - (Culinary Arts)	08/08/11
E-117	First Floor Power Plan - Part G - (Athletics)	08/08/11
E-118	First Floor Power Plan - Part H - (Career Technology & Physical Education)	08/08/11

Bid Package A and B- FOR REFERENCE ONLY

I G-001	Volume 1 - Cover Sheet	03-09-11
I G-002	Volume 1 – Cover Sheet	03-09-11
C-001B	Cover Sheet	05-09-11
C-201B	Grading, Utility and Erosion & Sediment Control Plan	05-09-11
C-202B	Grading, Utility and Erosion & Sediment Control Plan	05-09-11
C-203B	Grading, Utility and Erosion & Sediment Control Plan	05-09-11
C-500B	Erosion & Sediment Control Phasing Plan	05-09-11
C-501B	Stormwater Management Pond Details B	05-09-11
C-502B	Erosion & Sediment Control Details B	05-09-11
C-701B	Geothermal Grading Profiles	05-09-11
GM-101	Site Plan HVAC New Work	05-09-11
GM-201	Details HVAC	05-09-11
GM-202	Geothermal Header Vault Details HVAC	05-09-11
GM-203	Details HVAC	05-09-11
GE-105	Site Plan – Electrical Geothermal Vaults Plan & Details	05-09-11

Public notice is hereby given that sealed bids for the following prime contract will be received for the construction of New Dover High School located in Dover, Delaware. Bids will be received at the Professional Development Administration Building located at 198 Commerce Way Dover, Delaware 19904-8210 until 3:00 pm local time on April 16, 2013, at which time they will be publicly opened and read aloud. *Bidder bears the risk of late delivery. Any bids received after the stated time will be returned unopened.* The time and location of the bid opening may be extended with a minimum of two (2) calendar days' notice to the Bidders.

Contract NDHS-33:	Site, Field, Stadiums and Accessories
Contract NDHS-34:	General Construction
Contract NDHS-35:	Turf Field & Track
Contract NDHS 36:	Fencing, Gates & Backstops
Contract NDHS-37:	Site Concrete
Contract NDHS-38:	Bleachers & Grandstands
Contract NDHS-39:	Site Electrical
Contract NDHS-40:	Outdoor Scoreboards

Documents may be viewed and downloaded at the following FTP site after 4:00 PM on March 14, 2013:

bids.ediscompany.com
Log in: capitalhs
Password: edis0412

It is the responsibility of each bidder to review and coordinate all project documents. This includes plans, specifications and addendums. Please email Jackie McKee at jmmckee@ediscompany.com when you obtain documents via the FTP site so we can provide future bidding information to your company. Documents may be examined at the office of the Architect, ABHA 1621 N. Lincoln Street, Wilmington, DE 19806 the Construction Manager, EDiS Company, 110 S. Poplar Street, Suite 400, Wilmington, Delaware 19801; the office of Delaware Contractors Association, 527 Christiana Stanton Road, Newark, Delaware 19713; and F. W. Dodge Corporation, Conshohocken, Pennsylvania.

A bid security in the amount of 10% of the bid, plus consent of surety must accompany each bid. Bid Security shall specify the Owner as the obligee. Owner: Capital School District.

A pre-bid meeting will be held at Professional Development Administration Building located at 198 Commerce Way Dover, Delaware 19904-8210 on March 19, 2013 at 10:00 AM local time. Attendance is highly suggested but not mandatory.

Please contact EDiS Company, Kevin Lucas at 302-421-2893 or klucas@ediscompany.com with questions.

Conformance to the Delaware Architectural Accessibility Act and the standards of the Architectural Accessibility Board is required on the Project.

END OF SECTION

SECTION 00 21 13 - INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

1.1 Bidding Documents include the Contract Documents, Invitation to Bid, Instructions to Bidders, the Proposal Forms, Contract, General Conditions of the Contract, Supplementary Conditions, Specifications, Plans, and any Addenda issued prior to receipt of bids.

1.2 All definitions set forth in the General Conditions and the other Contract Documents are applicable to the Bidding Documents.

1.3 "Addenda" are written or graphic instruments issued by the Architect/Engineer prior to the receipt of bids which modify or interpret the Bidding Documents, by additions, deletions, clarifications or corrections. Addenda become part of the contract documents upon execution of the agreement.

1.4 The term Work is defined in 1.1.3 of the General Conditions.

1.5 A "Unit of Work" includes all Work covered by the one or more Sections of the specifications listed under that particular Unit of Work in Section 01 11 00 - SUMMARY OF WORK. A Unit of Work is the smallest portion of the Project for which a separate Bid will be accepted by the Construction Manager. The word "Unit" means "Unit of Work" whenever the context clearly implies "Unit of Work".

1.6 A "Bid" is a complete and properly signed proposal to do one or more Units of Work for the sum stipulated therein.

1.7 A "Bidder" is one who submits a Bid to the Bidding Agency for the Unit or Units of Work indicated therein.

1.8 A substantial amount of specification language constitutes definitions for terms found in other Contract Documents, including drawings, which must be recognized as diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article. Definitions and explanations to this section are not necessarily either complete or exclusive, but are general for the work to the extent not stated more explicitly in another provision of Contract Documents.

1.9 General Requirements (or Conditions) apply to entire work of Contract and, where so indicated, to other elements which are included in the project.

1.10 The term "indicated" is a cross reference to details, notes or schedules on the Drawings, to other similar means of recording requirements in the Contract Documents. Where terms such as "shown", "noted", "schedule" and "specified"

are used in lieu of "indicate," it is for purpose of helping to locate cross reference and no limitation of location is intended, except as specifically noted.

1.11 Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted" and "permitted" mean "directed by Construction Manager or Architect", "requested by Construction Manager or Architect", etc.

1.12 Where used in conjunction with Construction Manager's or Architect's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of the term "approved" will be held to limitations of Construction Manager's and Architect's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Construction Manager or Architect be interpreted as a release of Contractor from responsibilities to fulfill requirements of the Contract Documents.

1.13 The "Project Site" is the space available to Contractor for performance of the Work, either exclusively or in conjunction with others performing other work as part of the Project. The extent of project site is shown on the Drawings and may or may not be identical with description of the land upon which project is to be built. The Contractor shall visit the site to verify contract or construction limits.

1.14 Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

1.15 Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations as applicable in each instance.

1.16 Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

1.17 An "Installer" is the entity, person or firm, engaged by the Contractor or his subcontractor or sub-subcontractor for the performance of a particular unit of work at the project site, including installation, erection, application and similar required operation. It is a general requirement that such installers be expert in operations they are engaged to perform.

1.18 The duties and obligations of the Contract apply to this Contractor (as defined herein) regardless of similar or identical duties or obligations of other Prime Contractors related to the Project. Therefore, even though other Prime Contractors may have similar, identical or overlapping duties and obligations, each and every duty and obligation set forth in this Contract is enforceable against this Contractor.

2. BIDDER'S REPRESENTATION

2.1 Each Bidder in submitting its bid represents that:

1. It has read and understands the Bidding Documents and its Bid is made in accordance therewith.

2. Contractor has visited the site; familiarized himself with the local conditions under which the work is to be performed; compared the site with drawings and specifications; satisfied himself of the conditions of delivery, handling and storage of materials and all other matters that may be incidental to the Work before submitting his Bid.

3. Its Bid is based upon the materials and equipment described within the Bidding Documents without exceptions.

2.2 EVIDENCE OF REPRESENTATION

1. Submission of a Bid will be considered as evidence of the bidder's representation. No allowance will subsequently be made to the successful contractor by reason of any error omission on his part, due to his neglect in complying with the requirements of this article.

3. BIDDING DOCUMENTS

3.1 ISSUANCE

1. Bidding documents will be available from the EDiS FTP site bids.ediscompany.com. It is the responsibility of the bidders to be aware and familiar with all Contract Documents including previously issued Bid Packages.

2. Bidding Documents will not be issued to subcontractors or other individuals or organizations who will not be contracting directly with the Owner.

3. The complete set of Bidding Documents shall be used in preparing bids; neither the Owner, the Architect nor the Construction Manager assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

4. The Owner, Architect, and the Construction Manager, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining bids on the Work and do not confer a license or grant for any other use.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

1. Bidders shall examine the Bidding Documents carefully and shall promptly notify the Construction Manager of any ambiguity, inconsistency or error which they may discover. No request for adjustment of Contract Time or Sum shall be permitted with regard to any purported ambiguity, inconsistency or error not promptly noticed to the Construction Manager.

2. Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to the Construction Manager to reach him at least seven days prior to the date of receipt of bids.

3. Any interpretation, correction or change of the Bidding Documents will be made by Addendum. Interpretations, corrections, or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections, and changes.

3.3 SUBSTITUTIONS

1. Refer to Specification Section 01 62 00 - MATERIAL AND EQUIPMENT.

2. Substitution requests must be made at least seven (7) days prior to the receipt of bids.

3.4 ADDENDA

1. Addenda will be available at the FTP site; email will be used to notify each bidder of the addendums issued.

2. Sub-Bidders, Suppliers, Manufacturers and others wishing to have Addenda mailed free of charge directly to them should address a letter to the Construction Manager requesting a listing on the Addenda mailing list for this Project. Such letter must include no other subject matter, must clearly identify this Project by name, and must indicate, line for line, exactly how the name and address is to be typed on the envelope. Phone requests will not be accepted. The Construction Manager will endeavor, but expressly does not promise, to mail Addenda directly to those who have properly requested. Such mailing list is for this one Project only.

3. Addenda issued during the time of bidding shall be listed on Bid form in the space provided. Failure of a Bidder to receive any Addendum shall not release the Bidder from any obligations under his Bid, provided said addendum was

sent by fax or by U.S. Mail to the address furnished by the bidder for transmittal of mail. Faxed Addenda will be confirmed by U. S. Mail.

4. No Addenda will be issued later than three (3) days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which extends the time or changes the location for the opening of Bids.

4. BIDDING PROCEDURE

4.1 FORM AND STYLE OF BIDS

1. Bids shall be submitted in triplicate upon the proposal form included in these specifications, or upon an exact copy of it.

2. The Bidder shall complete all blank spaces on the Bid form.

3. Where indicated on the Bid form, sums shall be expressed in both words and figures. In case of discrepancy between the two, the written amount shall govern.

4. Any interlineation, alteration or erasure of an entry made in a blank space of the form must be initialed by the signer of the Bid. However, no interlineation, alteration or erasure shall be made in the wording printed on the bid form unless the Bidder is instructed by the Bidding Documents to do so. The Bidders shall add no stipulations or qualifications on the Bid form or accompanying the bid form unless permitted by or instructed by the Bidding Documents to do so.

5. All requested quantities, unit prices and alternates shall be included as part of the bid.

6. All signatures shall be in long hand.

7. The Bidder shall include on the Bid Form, within the Base Bid total costs associated with providing both the Labor and Material Payment and Performance Bonds.

8. The Bidder shall affix his seal to the bid form, if organized as a corporation.

4.2 SUBMISSION OF BIDS

1. Bids shall be deposited at the designated location prior to the time and date for receipt of Bids indicated in the Invitation to Bid, or any extension thereof made by Addendum. The time and location of the bid opening may be extended with a minimum of two (2) calendar days notice to the Bidders. Bids received

after the time and date for receipt of Bids will be marked "LATE BID" and returned.

2. The Bid Proposal (3 copies) shall be enclosed in a sealed envelope. The envelope shall be addressed to the Owner, and shall be identified with the Project name, the Bidder's name and address and the Unit of Work included in the Bid.

3. If the Bidder submits his Bid by mail, he shall enclose the above described sealed envelope in a separate mailing envelope with the notation "BID ENCLOSED' on the face thereof.

4. Bids shall include a fully executed Bid Bond, Power of Attorney, Non-collusion Statement, Consent of Surety and Subcontractor listing.

4.3 MODIFICATION OR WITHDRAWAL OF BID

1. A Bidder may modify his Bid in writing at any time prior to the time scheduled for receiving Bids, provided such written modification is received by the Construction Manager prior to said time.

2. Unless specifically authorized, faxed bids will not be considered.

3. No Bidder shall modify, withdraw or cancel his Bid or any part thereof for ONE HUNDRED TWENTY (120) days after the time designed for the receipt of Bids, in the Invitation to Bid. Any further extension of the time will be by mutual consent of the Owner and the Contractor.

4. A Bid may be withdrawn up until the time scheduled for receiving the Bids. Such withdrawal shall be in writing.

5. CONSIDERATIONS OF BIDS

5.1 OPENING OF BIDS

1. Bid shall be publicly opened and read aloud.

5.2 REJECTION OF BIDS

1. The Owner, in its sole discretion, shall have the right to reject any or all bids for any reason or for no reason whatsoever.

5.3 ACCEPTANCE OF BIDS

1. The Owner, in its sole discretion, shall have the right to waive any informality

or irregularity in any Bid received.

2. The Owner shall have the right to accept Alternates in any order or combination.

6. SUBCONTRACT INFORMATION

6.1 SUBMISSION OF SUBCONTRACTOR LIST

1. Should the Contractor fail to utilize any or all of the Subcontractors in the Contractor's Bid statement in the performance of the Work on the public bidding, the Contractor shall be penalized in the amount of (project specific amount *). The Agency may determine to deduct payment of the penalty from the Contractor or have the amount paid directly to the Agency. Any penalty amount assessed against the Contractor may be remitted or refunded, in whole or in part, by the Agency awarding the Contract, only if it is established to the satisfaction of the Agency that the Subcontractor in question has defaulted or is no longer engaged in such business. No claim for the remission or refund of any penalty shall be granted unless an application is filed within one year after the liability of the successful Bidder accrues. All penalty amounts assessed and not refunded or remitted to the Contractor shall be reverted to the State.

* one (1) percent of the contract amount not to exceed $10,000.

2. Upon request of the Construction Manager, the Bidder shall within seven (7) days of the request submit a list of the other subcontractors or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) if any, proposed for the various portions of the Work not included in the subcontractors list submitted with the bid.

3. The Bidder will be required to establish to the satisfaction of the Construction Manager the capability and experience of all proposed subcontractors to furnish and perform the work described in the sections of the specifications pertaining to such proposed subcontractor's respective trades.

4. Subcontractors and other persons and organizations proposed by the Bidder and accepted by the Owner must be used on the work for which they were proposed and accepted, and shall not be changed except with the written approval of the Construction Manager.

7. EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

During the performance of this Contract, the Contractor agrees as follows:

7.1 The Contractor will not discriminate against any employee or applicant for

employment because of race, creed, color, sex or national origin. The Contractor will take affirmative action to ensure the applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, sex or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.

7.2 The Contractor will, in all solicitants or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color sex, or national origin.

7.3 The term "Contract for public works" means construction, reconstruction, demolition, alteration and repair work and maintenance work paid for, in whole or in part, with public funds.

7.4 The Secretary of the Department of Labor shall be responsible for the administration of this section and shall adopt such rules and regulations and issue such orders as he deems necessary to achieve the purpose thereof, provided that no requirement established herby shall be in conflict with subchapter 6904 of this title.

8. PREVAILING WAGE REQUIREMENT

8.1 Wage Provisions: In accordance with Delaware Code, Title 29, Section 6960, renovation projects whose total cost shall exceed $15,000 and $100,000 for new construction, the minimum wage rates for various classes of laborers and mechanics shall be as determined by the Department of Labor, Division of Industrial Affairs of the State of Delaware.

8.2 The prevailing wage shall be the wage paid to a majority of employees performing similar work as reported in the Department's annual prevailing wage survey or in the absence of a majority, the average paid to all employees reported.

8.3 The Contractor shall pay all mechanics and labors employed directly upon the site of work, unconditionally and not less often than once a week and without subsequent deduction or rebate on any account the full amounts accrued at time of payment, computed at wage rates not less than those stated in the specifications, regardless of any contractual relationship which may be alleged to exist between the employer and such laborers and mechanics.

8.4 The scale of the wages to be paid shall be posted by the employer in a prominent and easily accessible place at the site of the work.

8.5 Every contract based upon these specifications shall contain a stipulation that certified sworn payroll reports be maintained by every Contractor and Subcontractor performing work upon the site of construction. The Contractor and Subcontractor shall keep and maintain the sworn payroll information for a period of 2 years from the last day of the work week covered by the payroll. A certified copy of these payroll reports shall be made available: 1) Effective June 30, 2007, all Contractors performing work on public work projects are required to furnish sworn payroll records on a weekly basis to the Department of Labor. Specifically, 29 Del. C. § 6960(c) states that "(e)very contract… shall contain a stipulation that sworn payroll information, as required by the Department of Labor, be furnished weekly." Further, that "(t)he Department of Labor shall keep and maintain the sworn payroll information for a period of 6 months from the last day of the work week covered by the payroll." Lastly, the failure to submit payroll reports shall be subject to a civil penalty of not less than $1,000 nor more than $5,000 for each violation. 29 Del. C. § 6960(e). Sworn payroll information shall consist of a fully completed and notarized report on a form provided upon request by the Department of Labor. *See* Delaware Prevailing Wage Regulations VII A.2(c)"; 2) upon request by the public or for copies thereof. However, a request by the public must be made through the Department of Labor. The requesting party shall, prior to being provided the records, reimburse the costs of preparation by the Department of Labor in accordance with the Department's copying fee policy. The public shall not be given access to the records at the principal office of the Contractor or Subcontractor; and 3) the certified payroll records shall be on a form provided by the Department of Labor or shall contain the same information as the form provided by the Department and shall be provided within 10 days from receipt of notice requesting the records from the Department of Labor.

9. PERFORMANCE AND PAYMENT BONDS

9.1 The Contractor shall be required to furnish bonds covering the faithful performance of the contract and the payment of all obligations arising thereunder with such sureties secured through the Bidder's usual sources as may be agreeable to the parties. The Owner shall be noted as the obligee.

9.2 The performance and payment bonds shall each be in an amount equal to 100% of the Contract Sum as adjusted from time to time. The Owner shall be noted as the obligee.

9.3 TIME OF DELIVERY AND FORM OF BONDS

1. The Bidder shall deliver the required bonds within seven (7) days from receipt of request from the Construction Manager.

2. The performance and payment bonds shall be written in the form found in Section 00 61 13 Performance and Payment Bonds.

3. The required bonds shall be by an authorized agent of the bonding company and shall be accompanied by a certified and current copy of the bonding agent's Power of Attorney, indicating the monetary limit of such power. The bonding company shall be licensed to operate in the state which the work is to be performed.

10. EXECUTION OF AGREEMENT

10.1 The Agreement will be written on a contract form, stipulated by the Owner, a copy of which is included in the Specifications.

10.2 The Bidder shall, within seven (7) days following its presentation, execute the Agreement and return it to the Construction Manager.

10.3 The Bidder agrees to commence work within seven (7) days of 1) execution of the Agreement, or 2) receipt of a Letter of Intent to execute the Agreement, or other authorization to proceed, if furnished at an earlier date.

10.4 If the successful Bidder fails to execute the required Contract and Bond, as aforesaid, within twenty (20) days after the date of official Notice of the Award of the Contract, their Bid guaranty shall immediately be taken and become the property of the State for the benefit of the Agency as liquidated damages, and not as a forfeiture or as a penalty. Award will then be made to the next lowest qualified Bidder of the Work or readvertised, as the Agency may decide.

11. GENERAL COMMENTS

11.1 JOINT VENTURE AGREEMENTS

In the event of a mandatory pre-bid meeting, representatives of both Joint Ventures must attend the pre-bid meeting and must be an officer and co-joint venture of the corporations involved.

Each Joint Venture shall be qualified and capable to complete the project with their own forces.

Included with the bid submission, and as a requirement to bid, a copy of the executed Joint Venture Agreement shall be submitted and signed by all Joint Ventures involved.

All required bid bonds, performance bonds, material and labor payment bonds must be executed by both Joint Ventures and be placed in both of their names.

All required insurance certificates shall name both Joint Ventures.

Both Joint Ventures shall sign the bid form and shall submit a valid Delaware Business License Number with their bid or shall state that the process of application for a Delaware Business License has been initiated.

Both Joint Ventures shall include their Federal E. I. Number with the bid.

Due to exceptional circumstances and for good cause shown, one or more of these provisions may be waived at the discretion of the Owner.

11.2 LICENSE APPLICATION REQUIRED TO BID

A business license application must be initiated prior to or in conjunction with the submission of a bid on competitively bid contracts exceeding $50,000; or in the case of a subcontractor, prior to the submission of a bid by the general contractor. The license application procedure may be initiated by visiting or calling the Division of Revenue.

11.3 BONDING REQUIREMENTS FOR NON-RESIDENT CONTRACTORS

All non-resident contractors are reminded that they must supply a surety or cash bond to the Division of Revenue equal to six percent (6%) of the total of all contracts exceeding $20,000 for construction within this state. For Division of Revenue purposes, cash bonds and bank letters of credit issued by financial institutions will be accepted on all contracts.

11.4 CONTRACT AWARD TO NON-RESIDENT CONTRACTORS

Every architect, or professional engineer or contractor or construction manager engaging in the practice of such profession shall furnish the Department of Finance within 10 days after entering into any contract with a contractor or subcontractor not a resident of this State, a statement of the total value of such contract or contracts together with the names and addresses of the contracting parties.

11.5 STATE LICENSE AND TAX REQUIREMENTS

The Contractor and Subcontractor shall be licensed to do business in the State of Delaware and shall pay al fees and taxes due under State laws. In conformance with Section 2503, Chapter 25, Title 30, Delaware Code, "the Contractor shall furnish the State Tax Department within ten (10) days after award of the Contract, a statement of the total values of each contract and subcontract, together with the names and addresses of the contracting parties . . ."

11.6 RIGHT TO AUDIT RECORDS

The Owner (contracting agency) shall have the right to audit the books and records of a Contractor or any Subcontractor under any Contract or Subcontract to the extent that the books and records relate to the performance of the Contract or Subcontract.

Said books and records shall be maintained by the Contractor for a period of three (3) years from the date of final payment under the Prime Contract and by the Subcontractor for a period of three (3) years from the date of final payment under the Subcontract.

END OF SECTION

SECTION 00 31 32 – GEOTECHNICAL DATA

1. GENERAL

1.1 Owner's Disclaimer

A. Site Information: Data on subsurface conditions are made available in the Bidding Documents as a convenience to Bidders and the Contractor. They are not intended as representations or warrants of continuity of such conditions between soil borings. It shall be expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Additional test borings and other exploratory operations may be made by the Contractor at no additional cost to the Owner, provided such operations are acceptable to the Architect and Construction Manager.

1.2 SOIL BORING DATA

A. Attached is the Geo-Technical Reports provided by Duffield Associates.

DUFFIELD ASSOCIATES

GEOTECHNICAL EVALUATION

DOVER HIGH SCHOOL
CAPITAL SCHOOL DISTRICT
DOVER, DELAWARE

December 2010

Prepared for:

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TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
EXECUTIVE SUMMARY		i
I.	INTRODUCTION	1
II.	FIELD AND LABORATORY TESTING PROGRAMS	3
	A. STANDARD PENETRATION TEST BORINGS	3
	B. BACKHOE EXCAVATED TEST PITS	4
	C. INFILTRATION TESTING	4
	D. LABORATORY TESTING	5
III.	SUBSURFACE CONDITIONS	5
	A. GENERALIZED SITE GEOLOGY	5
	B. STRATIGRAPHIC CONDITIONS	6
IV.	DISCUSSION OF ANALYSIS	7
	A. PROPOSED STRUCTURES	7
	B. FOUNDATIONS	8
	C. GROUNDWATER CONSTRUCTION CONSIDERATIONS	9
	D. SITE PAVEMENTS	9
	E. INFILTRATION TESTING	10
V.	CONCLUSIONS AND RECOMMENDATIONS	11
	A. DESIGN	11
	B. CONSTRUCTION	14

TABLE OF CONTENTS
(continued)

APPENDICES

Appendix A	Site Location Sketch
	Sampling Location Sketch, dated October 21, 2010
Appendix B	Test Boring Logs (29)
	Test Pit Logs (11)
	Infiltration Testing Plot (1)
Appendix C	General Notes

EXECUTIVE SUMMARY

This report summarizes Duffield Associates, Inc.'s (Duffield Associates) geotechnical evaluation for the proposed Dover High School campus to be located approximately 3.1 miles west of North DuPont Highway along State Road 8 (Forrest Avenue) in Dover, Delaware. The proposed construction includes a three-story high school, single-story field house, stands, various stormwater management facilities, site pavements, as well as several athletic fields. The high school and field house structures are anticipated to encompass footprints of approximately 235,000- and 10,000-square feet, respectively, and to be supported on shallow foundation and slab-on-grade systems (i.e., no basement level).

The project site consists of approximately 106.3 acres of undeveloped agricultural land. A manmade agricultural ditch extends in a southeast-to northwest orientation across the site. A proposed site grading plan was not available at the time of this evaluation. However, it is understood that only minor regrading (i.e., net "cuts" and "fills") on the order of 2 to 4 feet or less will be required to achieve the proposed site grades.

A total of twenty-nine (29) Standard Penetration Test borings extending to depths ranging from 5 to 50 feet below the ground surface, eleven (11) test pits extending to depths of up to 14.5 feet below the ground surface and four (4) single-ring infiltration tests were performed at the site between November 3 and 23, 2010. Beneath a surficial layer of topsoil, the subsurface conditions observed can generally be described as soft to stiff consistency silt or clay underlain by predominately very loose to medium dense silty sand. Groundwater was observed during performance of the field program at depths ranging from approximately 3.5 to 11.5 feet below the existing ground surface, corresponding to elevations ranging from approximately 46.3 to 39 feet, project datum.

In general, with the exception of the biofiltration swales proposed within the locations of I-4 and I-5, Duffield Associates generally does not recommend the utilization of infiltration practices at this site due to the generally shallow groundwater conditions observed, elevations of seasonal high water indications, and observed infiltration testing results.

Based on the observed subsurface conditions and the provided and assumed loading information, it is Duffield Associates' opinion that the proposed structures could be supported on shallow foundation systems and slabs-on-grade. A maximum net allowable bearing pressure of 2,500 pounds per square foot is recommended for the design of all foundations. Total foundation settlement is estimated to be on the order of 1 inch for the field house and stands and 1½ inches for the high school. Post-construction settlement is estimated to be ½ inch or less, with differential settlements between typical column or wall spacing within the footprint of the structures estimated to be ½ inch or less between adjacent columns or walls. Foundations should be supported on the predominately loose to medium dense apparent "natural" silty sand soil of Stratum C generally observed beneath Strata A and B (i.e., topsoil and silt or clay soils) or on compacted structural fill as recommended herein.

More detailed conclusions and recommendations for design and construction of the foundations, floor slabs and site pavements, as well as the stormwater management areas for the proposed site are provided in the following report.

I. INTRODUCTION

This report summarizes Duffield Associates, Inc.'s (Duffield Associates) geotechnical evaluation for the proposed Dover High School campus to be located approximately 3.1 miles west of North DuPont Highway along State Road 8 (Forrest Avenue) in Dover, Delaware. Included in this report is a summary of the data obtained during field and laboratory testing programs and a discussion of the subsequent geotechnical analysis. Recommendations for the design and construction of proposed building foundations, slabs, site pavements, and stormwater management areas are also provided. These services were performed in general accordance with an agreement between Duffield Associates and the Becker Morgan Group, Inc. (Becker Morgan), dated June 28, 2010, authorized to proceed on October 25, 2010.

To assist with the preparation of this report, Duffield Associates was provided with the following documents:

- A request for a subsurface and geotechnical engineering report prepared by the project's structural engineer, Baker, Ingram & Associates, dated June 1, 2010, delivered via electronic mail on June 1, 2010; and

- A sketch titled "Boring Locations – As Staked 2010-10-29," prepared by Becker Morgan, dated October 21, 2010, delivered via electronic mail on November 2, 2010, indicating the proposed site layout, existing topography and proposed sampling locations.

Based on discussions with the project team and the information provided, it is understood that it is proposed to construct a three-story high school, single-story field house, stands (i.e., bleachers along the east and west sides of the football field), various stormwater management facilities (i.e., two (2) ponds, six (6) biofiltration basins and one (1) biofiltration swale), site pavements (i.e., access drives and parking lots), as well as several athletic fields (i.e., 9 to 11 playing fields designated for football, soccer, field hockey, softball and baseball). Further, it is understood that an initially proposed "remote athletic structure" to consist of a relatively small building similar to the proposed field house is currently not being considered as part of the proposed project development.

The high school and field house structures are anticipated to encompass footprints of approximately 235,000- and 10,000-square feet, respectively. It is anticipated that the high school building structure will be supported on a shallow foundation and slab-on-grade system (i.e., no basement level). The proposed structure is to consist of steel and composite steel floor framing, concrete masonry block and cold-formed steel stud walls, and brick veneer construction. The remote field house is anticipated to be supported by shallow foundations, masonry bearing walls, and concrete framing construction. The football stands are proposed to be supported by a shallow foundation system.

The referenced request for subsurface and geotechnical engineering report provided the following anticipated loading conditions:

	Maximum Wall Loads (kips/linear foot)	Maximum Column Loads (kips)
High School	5	240
Remote Athletic Structure	3	0

No structural loading information for the proposed football stands was available at the time of this evaluation. Therefore, maximum column loads on the order of 50 kips have been assumed.

Becker Morgan indicated that the proposed high school and field house are anticipated to have finished floor elevations of 49.5 feet, project datum. It was indicated that the finished floor of the high school may be increased to elevation 50 feet depending on the finalized stormwater management design. A proposed site grading plan was not available at the time of this evaluation. However, it is understood that only minor regrading (i.e., net "cuts" and "fills") on the order of 2 to 4 feet or less will be required to achieve the proposed site grades.

At the time of this evaluation the project site consisted of approximately 106.3 acres of undeveloped agricultural land. A manmade agricultural ditch extends in a southeast-to northwest orientation across the site. Duffield Associates previously performed a wetlands evaluation report for Becker Morgan titled "Subaqueous Lands, Waters of the U.S. including Wetlands Evaluation Report, Capital School District – Proposed Dover High School Property," dated July 6, 2010, which concluded that the agricultural ditch was not classified as "wetlands" based on the methodology utilized to prepare the report. Duffield Associates submitted this report to the U.S. Army Corps of Engineers and to the State of Delaware at the request of Becker Morgan to determine if the water bodies on the property are jurisdictional and subjected to Federal or State laws. The U.S. Army Corps of Engineers and the State of Delaware indicated via written correspondence on November 4, 2010 and September 1, 2010, respectively that they agreed with Duffield Associates' conclusion and that no jurisdictional governance was applicable by either agency.

The site is relatively flat with existing elevations ranging from 45 to 55 feet, project datum. Generally, the site grades increase away from the agricultural ditch (i.e., east-to-west of the ditch) and from north-to-south across the site. The site is bound to the south by residential development including a large stormwater management pond, the southwest by agricultural land, the north by State Road 8 and residences adjacent to the south side of the road, and by undeveloped land to the northeast. An apparent farmhouse previously existed within the eastern half of the site but was demolished prior to the start of this field evaluation. However, the farmhouse driveway was still present and extends in a north-to-south orientation connecting to State Road 8.

Overhead utilities were present, crossing the majority of the project site in two different orientations (see the Sampling Location Sketch included in Appendix A for an approximate location). No underground utilities were located within the project site as a result of contacting Miss Utility prior to the start of the field work. It is understood that several underground utilities may be present within approximately 50 feet south of State Road 8 along the northern boundary of the site. However, this was not within the general area of the field exploration program. A terracotta pipe (apparent field drainage pipe) was encountered during the performance of test pit Nos. I-1A and I-2 at depths corresponding to 2.5 and 2 feet below the existing ground surface respectively. Although only observed at these two (2) sampling locations, it is anticipated that similar field drainage pipe may be present elsewhere on the site.

II. FIELD AND LABORATORY TESTING PROGRAMS

A. STANDARD PENETRATION TEST BORINGS

A total of twenty-nine (29) Standard Penetration Test borings (performed in general accordance with ASTM D 1586), extending to depths ranging from approximately 5 to 50 feet below the ground surface, were performed at the site from November 15 to 23, 2010. The test borings, designated as TB-S1 through TB-S13 (for structural borings), TB-B1 through TB-B10 (for civil site borings), and TB-R1 through TB-R6 (for roadway borings) were performed at locations as staked in the field by Becker Morgan prior to the start of the field evaluation. These locations were observed to be accessible to the drill rig and clear of existing utilities. The approximate test boring locations are indicated on the Sampling Location Sketch.

The test borings were performed by Feldmann Brothers, Inc. of Newark, Delaware, as a subcontractor to Duffield Associates, utilizing an ATV-mounted Diedrich D-50 drill rig with hollow-stem augers. Approximately twenty (20) of the test borings were performed utilizing mud-rotary drilling techniques. Duffield Associates' representative was present to review the performance of the test borings. Test boring logs, which describe the conditions observed during the field exploration program, are included in Appendix B.

At completion of the drilling, the boreholes were backfilled with the soil cuttings. Excess soil was mounded above the boring locations to compensate for potential future settlement of the boring backfill. However, additional settlement and softening of the soils replaced in the boreholes may occur, resulting in depressions or holes in the ground surface. Consequently, future maintenance and restoration of the site may be required.

B. BACKHOE EXCAVATED TEST PITS

The evaluation also included the performance of eleven (11) test pits designated as TP-1 through TP-5 and I-1A through I-6 performed on November 3 and 9, 2010, respectively. The test pits were performed by Feldmann Brothers, Inc. of Newark, Delaware as a subcontractor to Duffield Associates, utilizing a rubber-tired backhoe.

The test pits were extended to depths of up to 14.5 feet below the existing ground surface. Test pit locations were staked in the field by Becker Morgan prior to the start of the field evaluation. Ten (10) of the test pits were performed within the proposed stormwater management areas. Infiltration testing was performed in four (4) of the test pit locations. One (1) test pit was performed within the proposed athletic fields. A sketch indicating the approximate locations of the test pits is enclosed in Appendix A.

Duffield Associates' representative was present to review the performance of the test pits. Test pit logs, describing the conditions observed during the field exploration program, are included in Appendix B. At completion of the test pits, the excavations were backfilled with the excavated material and leveled with the existing ground surface. Settlement and softening of soils replaced in the test pits may occur, resulting in a depression or holes in the ground surface. Consequently, future maintenance and restoration of the site may be required.

C. INFILTRATION TESTING

A total of six (6) infiltration tests were initially proposed to be performed during the field evaluation. On November 3, 2010, five (5) test pit excavations were performed at the site. Four (4) of these test pits were performed within proposed stormwater management areas in an effort to evaluate conditions related to seasonal high groundwater level and groundwater seepage prior to performing infiltration testing. Following the performance of these test pits, Duffield Associates provided the project civil engineer (Becker Morgan) with preliminary field observations of seasonal high groundwater, groundwater seepage, and stratigraphy via electronic mail on November 4, 2010. These preliminary observations were discussed between Duffield Associates and Becker Morgan on November 5, 2010, and the initially proposed scope modified.

A total of (4) single-ring infiltration tests were performed at the project site at test pit location Nos. I-2, I-3, I-4 and I-5. The single-ring infiltration tests were performed in general accordance with ASTM D 3385 and D 5126. At the completion of the infiltration tests, additional excavation was performed with the backhoe to further evaluate the stratigraphy and the relative saturation over depth. Test pit logs, which describe the conditions observed during the field exploration program, are included in Appendix B. At completion of the test pits and

infiltration test operations, the test pits were backfilled with the excavated soil as described above. Results from the infiltration testing are provided below within the "Discussion of Analysis" section and Infiltration Testing Plots are located in Appendix B.

D. LABORATORY TESTING

Following completion of the field program, soil samples were returned to Duffield Associates' laboratory for testing of selected samples. The laboratory testing program for this evaluation included the determination of natural water content (ASTM D 2216), and silt/clay content (percent finer than a No. 200 sieve, ASTM D 1140) for a total of seventeen (17) soil samples and the performance of Atterberg Limits (liquid and plastic, ASTM D 4318) determinations for a total of three (3) soil samples obtained during the field evaluation. The laboratory testing program also included the determination of percent finer than a No. 270 sieve [silt/clay content in accordance with the United States Department of Agriculture (USDA) classification system] for four (4) soil samples obtained from the infiltration test locations. The results of these laboratory tests are included on the test boring and test pit logs included in Appendix B. No environmental testing or characterization was performed.

III. SUBSURFACE CONDITIONS

A. GENERALIZED SITE GEOLOGY

Regional geologic mapping by the Delaware Geologic Survey (DGS) indicates that the project site is located within the Atlantic Coastal Plain Physiographic Province. A review of geologic map Series No. 14 titled "Geologic Map of Kent County, Delaware," prepared by DGS, dated 2007 indicates that the surficial geology of the site is comprised of the middle Pleistocene Aged Columbia Formation. This formation is defined as fine to coarse, feldspathic quartz sand with varying amounts of gravel. Scattered beds of clayey silt are common. This stratigraphic unit is less than 50 feet thick and is interpreted to be primarily a body of fluvial glacial outwash sediment. This formation is underlain by the lower to middle Miocene Aged Calvert Formation. This formation is defined as clayey silt to silty clay interbedded with silty fine to coarse quartz sands and interpreted to be a marine deposit. Three major aquifers are located within the Calvert Formation within Kent County, Delaware. The project site is located within the Frederica Aquifer System Subgroup. This Calvert Formation ranges up to 425 feet in thickness.

B. STRATIGRAPHIC CONDITIONS

Beneath a surficial layer of topsoil, the subsurface conditions observed can generally be described as soft to stiff consistency SILT/CLAY underlain by very loose to medium dense silty sand. This silty sand stratum was only fully penetrated within sampling locations TB-S1 and TB-S9 which were extended to a depth of 50 feet below the existing ground surface. Within these test borings the silty sand stratum was underlain by a layer of medium to stiff consistency silt. This predominately fine-grained soil was underlain by medium to dense silty sand to the extent of the two (2) deeper test borings. The subsurface conditions encountered can generally be described as follows:

Stratum	Approximate Thickness (feet)	Generalized Description[1]
A[2]	0.4 – 1.1	TOPSOIL (approximately 5 to 13 inches)
B[3,4]	0.4 – 3.5	Light brown, gray, orange SILT or CLAY, trace to and fine sand, trace to little medium to coarse sand, trace to little gravel, trace organics (e.g., root material) (dry to moist, soft to stiff consistency); USCS: ML, CL
C[2,5]	33 – 35.5	Orange-brown, light gray, yellow, white, black fine to medium SAND, trace to and silt/clay, trace to and gravel, trace to some coarse sand (moist to wet, very loose to medium dense); USCS: SM, SC
D[5]	5 – 10	Dark gray SILT, trace to and fine sand (moist, medium stiff consistency); USCS: ML
E[6]	– – –[7]	Dark gray, white, orange fine SAND, little to some silt, trace to little medium to coarse sand (wet, medium to dense); USCS: SM

Notes:
1. The soil descriptions utilized herein and on the test boring and test pit logs are defined by the General Notes enclosed in Appendix C.
2. Stratum encountered within all sampling locations.
3. Stratum not encountered within sampling locations TP-4, TB-R1 through TB-R4, TB-R6, TB-B7, TB-B9, TB-B10, TB-S3, TB-S7, TB-S11 and TB-S12.
4. Stratum interbedded within Stratum C within sampling locations TB-S4 and TB-B1.
5. Stratum only fully penetrated within sampling locations TB-S1 and TB-S9.
6. Stratum not fully penetrated at any sampling location.

Groundwater observations made during the performance of the test borings and test pits are indicated on the logs included in Appendix B. Groundwater was observed during performance of the field program at depths ranging from approximately 3.5 to 11.5 feet below the existing ground surface, corresponding

to elevations ranging from approximately 46.3 to 39 feet (project datum). Groundwater levels at the site are likely to be affected by seasonal and annual variations in precipitation. It is estimated that variations in groundwater levels several feet higher or lower than those observed by this evaluation could be experienced during extreme variations in precipitation.

Groundwater mapping by DGS and the current State of Delaware, Department of Natural Resources and Environmental Control (DNREC) well permit database indicates groundwater levels in "normal," "dry," and "wet" conditions range from approximately 7 to 13 feet below the existing ground surface. The borings for this evaluation were performed during a relatively "dry" to "normal" period, and appear consistent with the database information.

IV. DISCUSSION OF ANALYSIS

A. PROPOSED STRUCTURES

Proposed High School

The proposed footprint of the high school is situated within the northwestern third of the site. As discussed, an existing agricultural ditch bisects the majority of the western and southern portions of the proposed high school footprint. It was observed that the existing site grading generally sloped towards the agricultural ditch. During the field evaluation, existing terracotta field drainage pipes apparently installed to facilitate field drainage towards the ditch were observed. The proposed finished floor elevation of the high school is anticipated to be 49.5 feet, project datum. To achieve this elevation "fills" on the order of up to 4 feet will be required. In general, the areas of the largest fills required to achieve the proposed finished floor elevation are located within the vicinity of the ditch and within the western and northwestern portions of the high school.

Proposed Field House

It is proposed to locate the field house within the eastern-third of the site adjacent to a proposed parking area located off of the main site access drive (see Sampling Location Sketch within Appendix A). It is understood that a location just north of the football field and south of the southeastern extent of the high school is also being considered. Analysis of this structure is based on the currently proposed location. The proposed finished floor elevation for this structure is anticipated to be 49.5 to 50 feet, project datum. The provided topographic information indicates that the existing site grades at this location are at approximately elevation 52 feet, project datum. Therefore, cuts on the order of 2 to 2.5 feet are anticipated to achieve the proposed finished floor elevation.

Proposed Football Field Stands

Two (2) areas of stands (i.e., bleachers) are proposed to extend in a north-to-south orientation along the eastern and western sides of the football and track and field area located southeast of the high school. The western stands are anticipated to be 1.5 to 2 times greater in plan area than the eastern stands. At the time of this evaluation, specific information (i.e., dimensions, framing and anticipated loading conditions) were not available for these structures. Therefore, a maximum column load (i.e., dead plus live loads) of 50 kips was assumed.

B. FOUNDATIONS

Based on the subsurface data obtained during this evaluation, it is Duffield Associates' opinion that the predominately loose to medium dense apparent "natural" silty sand soil of Stratum C, generally observed beneath Strata A and B (i.e., topsoil and silt or clay soils), is generally suitable for supporting the proposed structures on a shallow spread foundation system and slab-on-grade construction.

Structural fill, placed over suitable soils and compacted, as recommended in this report, is also considered suitable for supporting a shallow foundation system. Analysis indicates that the building foundations bearing on the Stratum C soils or on compacted structural fill could be sized for a maximum allowable bearing pressure of 2,500 pounds per square foot (psf). This analysis has assumed a shallow foundation system with a minimum width of 3 feet for isolated footings and 2 feet for continuous footings, and a minimum burial depth of 18 inches for interior footings and 24 inches for exterior footings.

Estimates of foundation settlement were performed to aid in evaluating the effects of the provided and assumed structural loads on the subsurface conditions. Based on this analysis, total foundation settlement is estimated to be on the order of 1 inch for the field house and stands and 1½ inches for the high school. Due to the presence of predominately granular soils beneath the proposed foundations, most of the estimated settlement should occur relatively quickly following the application of loads. Post-construction settlement is estimated to be ½ inch or less, with differential settlements between typical column or wall spacing within the footprint of the structures estimated to be ½ inch or less between adjacent columns or walls. These magnitudes of total and differential settlement are generally considered to be within tolerable limits for the types of structures proposed. However, the actual settlement tolerances of the structures should be verified with the project's structural engineer. If actual loading and/or grading conditions vary significantly from the assumptions of this analysis, Duffield Associates should be contacted to review and possibly modify this analysis.

C. GROUNDWATER CONSTRUCTION CONSIDERATIONS

Groundwater was observed at a range of depths between approximately 3.5 to 11.5 feet below the existing ground surface, corresponding to elevations ranging from approximately 46.3 to 39 feet (project datum). Groundwater levels at the site are likely to be affected by seasonal and annual variations in precipitation. It is estimated that variations in groundwater levels several feet higher or lower than those observed by this evaluation could be experienced during extreme variations in precipitation. Therefore, depending on seasonal variations in precipitation, it is possible that groundwater could be encountered during shallow foundation construction for the proposed structures resulting in wet conditions and seepage during construction. Additionally, groundwater may be encountered within and adjacent to the existing agricultural ditch during construction.

Based on the relatively shallow groundwater conditions observed during the field evaluation and the presence of standing water within the existing agricultural ditch, it appears that groundwater control methods will need to be utilized at the site in order to facilitate the proposed construction. Typically, dewatering during construction can be accomplished using a series of localized sumps installed along the length of an excavation during shallow foundation construction. Well points could also be considered for deeper excavation, utility construction, etc. Groundwater collected during construction should be discharged in accordance with local regulatory requirements. If lowering of the groundwater table is performed during construction, the effects on nearby structures should also be monitored.

D. SITE PAVEMENTS

Based on the information available to date, it is assumed that minor regrading (i.e., net cuts/fills of 2 to 3 feet or less) will be required to achieve the finished pavement grades. Based on the sampling locations performed within the proposed pavement areas (i.e., TB-R1 through TB-R6, TB-B1, TB-B3, TB-B4, TB-B7, TB-B10 and TB-S13), the subsurface conditions generally consist of a surficial layer of topsoil overlying either predominately fine-grained soils (Stratum B) or granular soils (Stratum C). Where encountered, the fine-grained soils (Stratum B) were relatively shallow, ranging in depth from approximately 2 to 4 feet below the existing ground surface.

The fine-grained soils correspond to the American Association of State Highway and Transportation Officials (AASHTO) classifications A-4 and A-5. A-4 and A-5 soils are classified as “fair to poor” subgrade soils and typically require a deeper paving section to provide drainage and reduce frost susceptibility than predominantly granular subgrade soils. The coarse-grained soils correspond to AASHTO classification A-2. A-2 soils are classified as “excellent to good” subgrade soils.

The fine-grained soils of Stratum B would be considered as "fair to poor" subgrade soils in the classification system described above. However, the underlying granular soils encountered across the site meet the "excellent to good" subgrade soil criteria. Depending on the final pavement grading, pavement subgrade elevations may be below the relatively shallow depth of the "fair to poor" subgrade soils of Stratum B, and could likely be designed assuming "excellent to good" subgrade conditions. The final proposed grading should be reviewed with the subgrade conditions described herein to determine proper pavement design parameters. Further recommendations regarding pavement design are included in the conclusions and recommendations section of this report.

E. INFILTRATION TESTING

The table below summarizes the infiltration and geotechnical laboratory testing results for the soils at the approximate depth of infiltration testing.

Infiltration Test Location	Elevation of Test (Ft., Project Datum)	Depth Below Grade (Ft.)	USDA Description	USCS Description	Average Field Infiltration Rate (In/Hr)
I-2	43.5±	1.5±	Silty Loam	Silt	0.04
I-3	43.5±	3.5±	Sandy Loam	Silty Sand	0.27
I-4	45.2±	4.5±	Sandy Loam	Silty Sand	1.84
I-5	48.8±	4.0±	Sandy Loam	Silty Sand	2.62

Several soil series are identified by the Kent County Soil Survey within the area of the project site. These soil series include the Fallsington, Sassafras and Woodstown Soil Series. The Kent County Soil Survey provides estimated "permeability" rates of 2.0 to 6.3, 0.63 to 6.3 and 0.63 to 2.0 inches/hour for the aforementioned shallow site soils respectively. The test results for I-2 and I-3 were well below the anticipated infiltration range referenced within the Kent County Soil Survey.

In general, with the exception of the biofiltration swales proposed within the locations of I-4 and I-5, Duffield Associates generally does not recommend the utilization of infiltration practices at this site due the generally shallow groundwater conditions observed, elevations of seasonal high water indications, and observed infiltration testing results.

V. CONCLUSIONS AND RECOMMENDATIONS

Based on the data obtained in the field and laboratory testing programs and the subsequent geotechnical analysis, the following conclusions and recommendations are presented.

A. DESIGN

1. **Allowable Foundation Bearing Capacity.** It is Duffield Associates' opinion that the predominately loose to medium dense apparent "natural" silty sand soil of Stratum C, generally observed beneath Strata A and B (i.e., topsoil and silt or clay soils), is generally considered suitable for supporting the proposed structures on shallow foundation systems. Structural fill, placed over suitable soils, compacted and reviewed, as recommended in this report, is also considered suitable for supporting shallow foundations. It is recommended that the proposed foundations for all structures be designed for a maximum net allowable bearing pressure of 2,500 psf.

2. **Estimated Foundation Settlement.** Settlement of the site soils will result from the proposed site grading and loads. Total foundation settlement is estimated to be on the order of 1 inch for the field house and stands and 1½ inches for the high school. Due to the presence of predominately granular soils beneath the proposed foundations, most of the estimated settlement should occur relatively quickly following the application of loads. Post-construction settlement is estimated to be ½ inch or less, with differential settlements between typical column or wall spacing within the footprint of the structures estimated to be ½ inch or less. These magnitudes of total and differential settlement are generally considered to be within tolerable limits for the types of structures proposed. However, the actual settlement tolerances of the structures should be verified with the project's structural engineer. If actual loading and/or grading conditions vary significantly from the assumptions of this analysis, Duffield Associates should be contacted to review and possibly modify this analysis.

3. **Foundation Burial Depth and Size.** The base of all exterior spread footings in areas exposed to frost should be placed at least 24 inches below final exterior grade. Interior foundations in insulated areas should be placed at least 18 inches below the proposed finished floor elevation. All isolated column footings should be at least 3 feet wide, and all continuous wall footings should be at least 2 feet wide regardless of bearing pressure. Some undercut excavation of the Stratum B silt or clay soils may be required to bear the building foundations on suitable soils. If a winter construction schedule is proposed for the foundations, provisions for the protection of shallow foundations from frost heave during construction should be included in the contract specifications.

4. **Slab-On-Grade.** Ground-supported floor slabs for the proposed structures should be designed as fully floating and not connected to the other structural elements of the building. It is anticipated that the slab-on-grade will be constructed over suitable Stratum B silts or clay, Stratum C sand, or structural fill soil. The foundation-slab interface and partition wall-slab interface should also be designed to allow relative movement. Control joints should be utilized, within the slab, to control the location of possible cracking due to differential slab settlement. Slabs should be provided with a minimum 4-inch drainage layer (AASHTO SP No. 57 stone) and minimum 10-mil polyethylene vapor barrier. Subgrade conditions should be modeled for design utilizing a subgrade modulus; K_S, of 150 pci, assuming subgrade preparation is performed, as discussed herein.

5. **Retaining Walls.** Backfill pressures on "unyielding" retaining walls restrained from rotation at the top be analyzed using the "at rest" earth pressure coefficient, K_O. The "active" and "passive" earth pressure coefficients, K_A and K_P, respectively, should be utilized for the design of "yielding" retaining walls such as cantilevered walls. Retaining walls should typically be provided with free draining backfill materials and a drainage system or weep holes to relieve hydrostatic pressures on the walls. The free draining backfill materials should extend behind the wall with its top at least as wide as 60% of the wall height.

   Based on the conditions encountered in this evaluation, it is anticipated that on-site fill materials will consist primarily of the fine-grained soils of Stratum B and the granular soils of Stratum C. The predominately fine-grained soils of Stratum B should not be utilized for wall backfill. Should sufficient quantities of the granular soils of Stratum C not be available, off-site granular borrow could also be utilized for wall backfill. Recommended lateral earth pressure parameters for design are presented below.

Backfill Materials	**K_A**	**K_P**	**K_O**	**Coeff. of Sliding Friction**	**Moist Unit Weight (pcf)**
Stratum C soils	0.35	2.9	0.52	0.37	125
Imported Granular Fill (with less than 25% passing a No. 200 sieve)	0.28	3.5	0.44	0.45	130

6. **Control Joints.** Masonry walls should be provided with frequent control joints placed at architecturally convenient locations, such as windows and doorways, to provide a "preferred" location for the differential settlement to occur without cracking the walls.

7. **Seismic Design Parameters.** Based on subsurface conditions encountered during the field exploration at the site and review of regional geologic maps, a Site Class "E," as defined by Table 1613.5.2 of the 2006 International Building Code, is recommended.

8. **Infiltration Test Results.** A total of four (4) field infiltration tests were performed in the vicinity of the proposed stormwater management areas. The infiltration tests were performed at depths ranging from approximately 1.5 to 4.5 feet below the existing ground surface. The tests were performed at the elevations recommended or determined based on the subsurface conditions exposed during excavation. With the exception of the biofiltration swales proposed within the locations of I-4 and I-5, Duffield Associates generally does not recommend the utilization of infiltration practices at this site due the generally shallow groundwater conditions observed, elevations of seasonal high water indications, and observed infiltration testing results.

9. **Site Grading.** Site grading should be designed to provide positive drainage away from the locations of the proposed structures. Positive site drainage should be maintained throughout construction activities.

10. **Pavement Design.** Based on the assumed site grading, it appears that the pavement subgrades will primarily consist of the predominantly sandy soils of Stratum C.

    Traffic loading consisting primarily of passenger vehicles in the proposed parking areas (with limited access to trash collection vehicles and other truck traffic) is anticipated. Additional recommendations are included for areas where limited truck or bus traffic is proposed.

    Based on the conditions encountered in this evaluation and assuming subgrade preparation as discussed herein, the following minimum pavement sections for parking lots and driveways are recommended:

Location	Bituminous Concrete Wearing Course, Type C (inches)	Bituminous Concrete Binder Course, Type B (inches)	Graded Aggregate Base Course, Type A (inches)	Total Thickness (inches)
Parking Areas	2	2	8[1]	12
Traffic lanes, dumpster areas and bus areas	2	3	12[1]	17

NOTES:
1. The installation of a 6 ounce, non-woven, Geotextile Fabric (Geotex 601 or equivalent) is recommended between the prepared subgrade and graded aggregated base course to reduce the potential for migration of the "natural" site soils into the pavement section.
2. All pavement construction and materials should conform to the Delaware Department of Transportation Standard Specifications for Roadway and Bridge Construction, dated August 2001 and as subsequently revised.

11. **Stormwater Management Areas.** The following recommendations are provided for the stormwater management areas:

- As discussed in the Infiltration Testing section of this report, with the exception of the biofiltration swales proposed within the locations of infiltration tests I-4 and I-5, Duffield Associates generally does not recommend the utilization of infiltration practices at this site, due the generally shallow groundwater conditions observed, elevations of seasonal high water indications, and observed infiltration testing results.

- Observations during the field testing program and the results of laboratory testing indicate that soils typically recommended by the U.S. Soil Conservation Service (SCS) Pond Code 378 for embankment fills and low permeability soil liner construction (USCS: CL, CH, SC, GC) are not likely present in sufficient quantities to facilitate pond construction. However, the fine-grained soils of Stratum B may be suitable for embankment pond construction. If additional laboratory testing confirms the presence of suitable soils the project team may want to consider further field investigation in order to estimate the available quantity of these soils. If suitable soils are determined to not be present at the site, all imported embankment fill should meet the material requirements as recommended in SCS Pond Code 378.

- Stormwater management areas, infiltration design and construction should be performed in accordance with the DNREC "Delaware Sediment &

Stormwater Regulations," dated January 23, 1991, most recently revised October 11, 2006.

- Stormwater embankment ponds should be designed in accordance with the SCS Pond Code 378.

12. **Assumptions.** This evaluation has been based on the information provided regarding the proposed finish floor elevations, structures and loading conditions. Assumptions regarding the design loads for the proposed football stands should be verified by the project team prior to the completion of their design. If the proposed loading conditions vary from those utilized, Duffield Associates should be notified to possibly modify the recommendations provided herein, as required.

B. CONSTRUCTION

1. **Proofroll and Subgrade Preparation.** At the start of construction, the proposed building construction and pavement areas should be stripped of all topsoil. Variable topsoil depth should be anticipated due to the past usage of the area for agricultural purposes. Following rough grading and prior to footing excavation, placement of fill, or construction of the floor slabs, it is recommended that the exposed subgrade be proofrolled. The proofroll should be performed using a minimum 10-ton vibratory roller in the presence of a qualified soils technician working under the supervision of a geotechnical engineer. The purpose of the proofrolling is to densify the subgrade soils and identify yielding subgrade conditions. Yielding or otherwise unsuitable subgrade conditions encountered within the proposed building areas should be undercut to firm subgrade conditions and backfilled with compacted structural fill in accordance with the recommendations of this report. Scarification and recompaction could also be performed in lieu of undercutting. A qualified soils technician working under the supervision of a geotechnical engineer should confirm the consistency and texture of the exposed soils with the conditions encountered by this evaluation, as described herein.

2. **Foundation Subgrade Review.** All shallow foundations should be placed on firm, dry, non-frozen subgrade consisting of the natural site soils of Stratum C or structural fill. Foundation excavations should be reviewed by a qualified technician working under the supervision of a geotechnical engineer who is familiar with the recommendations of this report. (Note: It is anticipated that the silt or clay soils of Stratum B will be encountered during foundation excavation. Where encountered, these soils were generally observed directly beneath the surficial topsoil and should be excavated to the suitable bearing soils of Stratum C). Subgrade review should be performed prior to the placement of reinforcing steel or concrete and should verify the presence of these soils. If these conditions are not encountered at the proposed foundation

depth, additional excavation should be performed until they are uniformly encountered across the base of the foundation's excavation or, if acceptable to the project geotechnical engineer, the natural soils can be densified in place. Foundation undercut areas should be backfilled with structural fill as recommended herein.

3. **Re-use of On-Site Soils as Structural Fill.** On-site soils free of organic material, topsoil, miscellaneous fill, debris and rock fragments in excess of 3 inches in their largest dimension may be suitable as structural fill. The shallow site soils consist primarily of the fine-grained soils (silt or clay) of Stratum B and the granular soils of Stratum C. The Stratum C soil may be suitable for re-use as structural fill. While it is possible that fine-grained soils could be utilized as structural fill or foundation backfill, some of these soils were encountered with an in-situ moisture content that exceeds the typical range that would allow the recommended compaction to be achieved. As a result, drying of these soils may be required to achieve the recommended compaction. Drying fine-grained soils requires an area in which to spread them out, extended periods of warm, dry weather, and time.

   If sufficient quantities of suitable on-site soils are not available for structural fill, imported borrow consisting of predominately granular soils conforming to the requirements of the Delaware Department of Transportation Standard Specifications Select Borrow, Type G should be utilized. AASHTO SP-57 stone could also be utilized as structural fill and should be considered for localized, relatively deep fills such as within the agricultural ditch, foundation undercuts or wall backfill if applicable.

4. **Compaction Requirements.** Structural fill utilized within the proposed building areas should be placed in loose lifts with a maximum thickness of 8 inches. Each lift of fill placed within the proposed building areas (defined as the area extending at least 5 feet beyond the building perimeter) should be compacted to at least 95% of the maximum dry density, as determined by the Modified Proctor test (ASTM D 1557). Structural fill for utility trenches, wall backfill and pavement areas, located outside of the proposed building should be compacted to at least 90% of the maximum dry density. The placement and compaction of structural fill should be monitored on a full-time basis by a qualified technician under the supervision of a geotechnical engineer.

5. **Groundwater Control.** Groundwater was observed at a range of depths between approximately 3.5 to 11.5 feet below the existing ground surface, corresponding to elevations ranging from approximately 46.3 to 39 feet (project datum). Due to seasonal fluctuations in precipitation, higher groundwater elevations than those encountered are possible. Based on the subsurface conditions encountered, it is anticipated that groundwater conditions will be at or slightly below the depth of typical shallow foundation

excavation. Groundwater is also anticipated to be encountered within and adjacent to the existing agricultural ditch. Further, due to the observed fine-grained shallow site soils of Stratum B, it is considered possible that localized perched groundwater may be encountered at relatively shallow depths within footing or utility excavations. If groundwater is encountered, localized sumping may be required. Wherever significant quantities of groundwater are encountered during foundation and utility trench excavations, it may become necessary for the resulting excavation to be over excavated by several inches and backfilled with AASHTO SP-57 stone to facilitate sumping and protect the exposed subgrade during construction. Deeper well points should also be considered for deeper excavation, utility construction, etc. Groundwater collected during construction should be discharged in accordance with local regulatory requirements. Additionally, if lowering of the groundwater table is performed during construction, the effects on nearby structures should also be monitored.

6. **Protection of Subgrade Soils.** Subgrade soils disturbed by precipitation and construction traffic should be either scarified and recompacted, or undercut and replaced with structural fill as previously discussed. Subgrade disturbance could be reduced by maintaining positive surface drainage, by establishing and maintaining a sump throughout the construction period, and by limiting construction traffic on the exposed subgrade soils. Where construction traffic is required over the subgrade soils, construction of a temporary haul road, consisting of at least 8 inches of crushed stone (Type B aggregate) over a geotextile fabric (e.g., Geotex 315 or equivalent) should be considered. A thicker stone section will likely be required for prolonged heavy use by trucks. Additional stone can be added later as needed.

7. **Excavation Safety.** All utility and foundation excavation should be performed in accordance with OSHA guidelines. Typically, the predominately granular soils can be characterized by OSHA CFR Part 1926 Excavation Standards as Type C soils. Should it be required, all temporary sheeting and shoring should be designed by a qualified engineer registered in the State of Delaware.

8. **Subsurface Data.** All contractors interested in bidding on phases of this work which involve subsurface conditions should be given full access to this report so that they can develop their own interpretations of the available data.

These recommendations have been prepared according to generally accepted soil and foundation engineering standards and are based on the conditions encountered by the sampling performed at the site. It is noted that, although soil quality has been inferred from the interpolation of the sampling data, subsurface conditions beyond the sampling points are, in fact, unknown. As a result, these recommendations may require modifications based on the conditions encountered and exposed during construction excavation. Should any conditions encountered during construction differ from those described in this report, this office should be notified immediately in order to review and

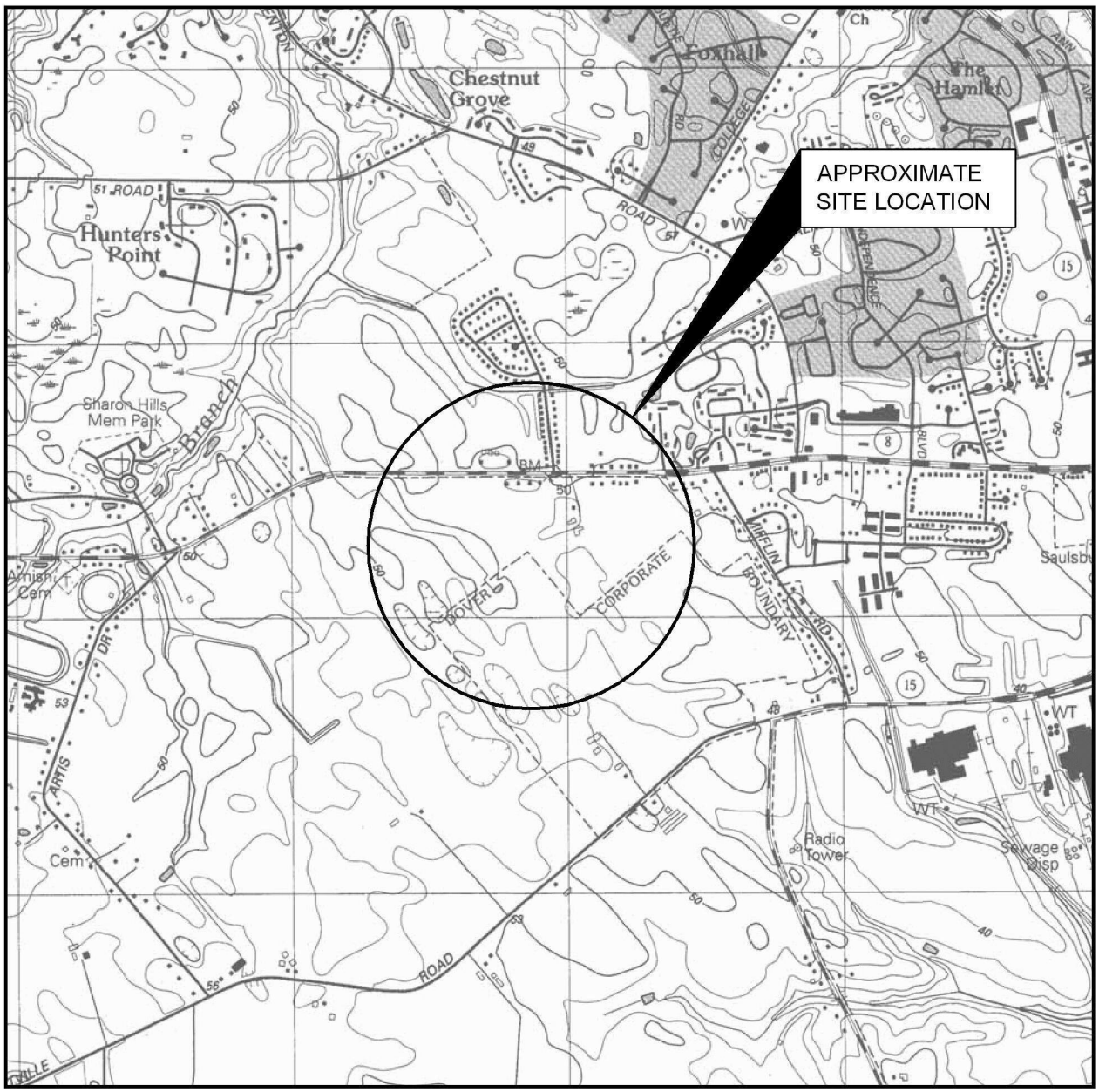
possibly modify these recommendations. The cost for this construction review is not part of the existing agreement. This report applies solely to the size, type and location of the structures described herein. In the event that changes are proposed, this report will not be considered valid unless the changes have been reviewed and the recommendations of this report modified and reapproved in writing by Duffield Associates, Inc.

WORD\7158GC.1210-DOVER HIGH SCHOOL.RPT

APPENDIX A

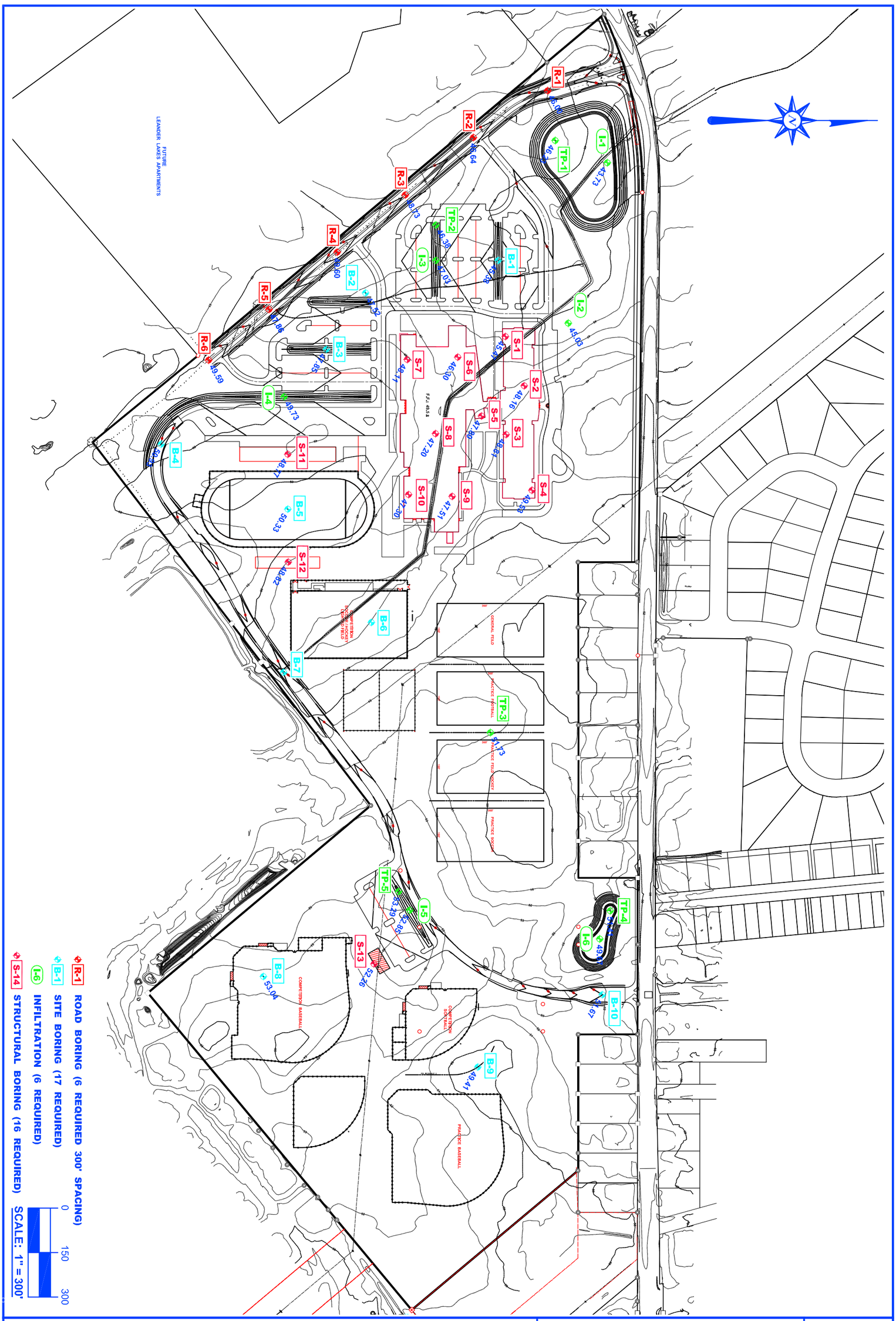
SITE LOCATION SKETCH

SAMPLING LOCATION SKETCH



NOTE:
THIS LOCATION SKETCH IS ADAPTED FROM THE U.S.G.S. TOPOGRAPHIC MAP, 7.5 MINUTE SERIES, FOR DOVER, DELAWARE 1993.

DATE: 3 NOVEMBER 2010	SITE LOCATION SKETCH	DESIGNED BY: KMY	DUFFIELD ASSOCIATES Consultants in the Geosciences
SCALE: 1"=2000'	CAPITAL SCHOOL DISTRICT - DOVER HIGH SCHOOL GEOTECHNICAL EVALUATION	DRAWN BY: EMP	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 7158.GC		CHECKED BY: KMY	OFFICES IN DELAWARE, MARYLAND PENNSYLVANIA AND NEW JERSEY
SHEET: FIGURE 1	DOVER ~ KENT COUNTY ~ DELAWARE	FILE: A-7518GC-01	E-MAIL: DUFFIELD@DUFFNET.COM



ROAD BORING (6 REQUIRED 300' SPACING) R-1

SITE BORING (17 REQUIRED) B-1

INFILTRATION (6 REQUIRED) I-6

STRUCTURAL BORING (16 REQUIRED) S-14

SCALE: 1" = 300'

0 150 300

BORING LOCATIONS - AS STAKED 2010-10-29

DOVER HIGH SCHOOL
CAPITAL SCHOOL DISTRICT

CITY OF DOVER

KENT COUNTY, DELAWARE

11x17-300-Boring

BECKER MORGAN GROUP

ARCHITECTURE
ENGINEERING
Dover

309 S. Governors Ave.
Dover, DE 19904
Ph. 302.734.7950
Fax 302.734.7965

BMG:	2010057
SCALE :	1" = 300'
DATE :	10/21/10
DRAWN BY :	M.A.R.

1

F:\AutoCAD\Projects\2010\2010057\survey\2010057-SITE-BLK-2010-10-28.dwg, Nov 02, 2010 - 4:00pm

APPENDIX B

TEST BORING LOGS (29)

TEST PIT LOGS (11)

INFILTRATION TESTING PLOT (1)

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-S1

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 18, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 18, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 45.4 feet ± Project Datum
Weather	: Partly cloudy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 20

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 45.4 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0	45			TOPSOIL (± 12 inches)							
			SC	Dark gray, gray, orange, white fine SAND and CLAY, trace medium to coarse sand, trace gravel; LIQUID LIMIT = 17, PLASTICITY INDEX = 1	X	S-1	5-4-6	1.3	13.3	46.9	
			SM	Gray, light brown, orange-brown fine SAND, some to and silt (moist) Gray, light brown, white fine SAND, some silt, trace gravel, trace medium to coarse sand (moist)	X	S-2A S-2B	3-2-2	1.1			▼
5	40			Varicolored (Brown, white, gray, red-brown) fine to medium SAND, little to some coarse sand, little gravel, trace silt (wet)	X	S-3	3-3-5	1.4			
10	35			Orange-brown, dark gray, white fine to medium SAND, little to some coarse sand, little to trace gravel, trace silt (wet)	X	S-4	2-3-5	1.1			
15	30			Orange-brown, white, red-brown, orange-yellow fine to medium SAND, little gravel, trace coarse sand, trace silt (wet)	X	S-5	2-3-4	1.4			
20	25			Orange, red-orange, yellow fine to medium SAND, little silt, trace coarse sand, trace gravel (wet)	X	S-6	4-4-8	1.4			
25	20			Brown, orange-brown, black, red-brown, white fine to medium SAND, little to some coarse sand, little to trace gravel, trace silt (wet)	X	S-7	6-7-8	1.3			

NOTES:
1. Test boring terminated at ± 50.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-rod conditions observed at 4.9 feet b.e.g.s.
4. Water elevation at 4.2 feet b.e.g.s. with augers at 6.0 feet b.e.g.s. after obtaining sample S-3.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 50 feet b.e.g.s.
6. Borehole dry and caved at 2.4 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-S1

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 18, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 18, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 45.4 feet ± Project Datum
Weather	: Partly cloudy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 20

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 45.4 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
30	15		SM	Orange, yellow-gray, red-brown, white, gray fine to medium SAND, little to some coarse sand, little gravel, little silt (wet)	X	S-8	7-6-8	1.5			
35	10		SM	Orange, red-brown, brown, black, yellow-white fine SAND, some medium to coarse sand, little silt, trace gravel (wet)	X	S-9	5-9-15	1.5			
40	5		ML	Dark gray SILT, some to and fine sand (moist)	X	S-10	3-5-8	1.5			
45	0		SM	Dark gray fine SAND, little silt, trace coarse sand (moist); NON PLASTIC	X	S-11	6-5-6	1.5	23.9	15.7	
50	-5		SM	Dark gray fine SAND, little silt, little medium to coarse sand (wet)	X	S-12	13-17-25	1.4			

NOTES:
1. Test boring terminated at ± 50.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-rod conditions observed at 4.9 feet b.e.g.s.
4. Water elevation at 4.2 feet b.e.g.s. with augers at 6.0 feet b.e.g.s. after obtaining sample S-3.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 50 feet b.e.g.s.
6. Borehole dry and caved at 2.4 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-S2

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 19, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 48.2 feet ± Project Datum
Weather	: Partly cloudy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 0

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 48.2 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 13 inches)							
			ML	Gray, red-brown, brown SILT, some to and fine sand, trace medium to coarse sand, trace fine gravel (moist)	X	S-1	2-2-6	1.4			
	45			Gray, red-orange, white fine SAND, some to and SILT, trace medium to coarse sand, trace gravel (moist)	X	S-2	7-9-12	1.3			
5				Orange-brown, gray, gray-brown, fine SAND, some silt, trace medium to coarse sand, trace gravel (moist)	X	S-3	4-5-8	1.3			▼
	40			Orange-brown, red-brown, yellow-white fine to medium SAND, little coarse sand, trace gravel, trace silt (wet)	X	S-4	3-4-5	1.4			
10											
	35		SM	Orange, brown, white fine SAND, little medium to coarse sand, little silt (wet)	X	S-5	2-1-3	1.5	29.0	16.6	
15											
	30			Orange, red-orange, yellow fine SAND, little silt, trace medium to coarse sand, trace gravel (wet)	X	S-6	2-2-3	1.3			
20											
	25			Orange, orange-yellow, red-brown, white fine to medium SAND, trace silt, trace coarse sand (wet)	X	S-7	4-2-4	1.5			
25											

NOTES:
1. Test boring terminated at ± 30.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 6 feet b.e.g.s.
4. Water elevation at 6.4 feet b.e.g.s. with augers at 6 feet b.e.g.s. after obtaining sample S-3.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 30 feet b.e.g.s.
6. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-S2

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 19, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 48.2 feet ± Project Datum
Weather	: Partly cloudy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 0

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 48.2 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
	20		SM	Orange-brown, red-brown, yellow fine to medium SAND, little to trace silt, trace coarse sand, trace gravel (wet)		S-8	6-10-11	1.5			
30											
	15										
35											
	10										
40											
	5										
45											
	0										
50											
	-5										

NOTES:
1. Test boring terminated at ± 30.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 6 feet b.e.g.s.
4. Water elevation at 6.4 feet b.e.g.s. with augers at 6 feet b.e.g.s. after obtaining sample S-3.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 30 feet b.e.g.s.
6. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-S3

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 19, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 48.8 feet ± Project Datum
Weather	: Partly cloudy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 30

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 48.8 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 9 inches)							
			SM	Brown, orange-brown fine SAND, some silt (moist)	X	S-1	2-1-5	1.5			
	45			Gray, orange fine SAND, some to and silt (moist) Orange-brown, brown, red-brown, white fine SAND, little gravel, trace medium to coarse sand, trace silt (moist)	X	S-2A S-2B	6-18-24	1.5			
5				Orange, orange-brown fine SAND, little silt (moist)	X	S-3	5-7-7	1.5			▼
	40			Orange, red-brown fine SAND, little silt, trace medium sand (wet)	X	S-4	2-3-3	1.5			
10											
	35			Yellow-brown, red-brown, white fine to medium SAND, little to some coarse sand, little silt (wet)	X	S-5	2-3-6	1.5			
15											
	30			Light yellow, light orange-brown, white fine to medium SAND, little coarse sand, trace silt (wet)	X	S-6	4-4-6	1.5			
20											
	25			Orange, yellow-orange fine to medium SAND, little coarse sand, trace silt (wet)	X	S-7	4-4-4	1.5			
25											

NOTES:
1. Test boring terminated at ± 30.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 7.9 feet b.e.g.s.
4. Water elevation at 7.7 feet b.e.g.s. with augers at 8.5 feet b.e.g.s.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 30 feet b.e.g.s.
6. Borehole caved at approximately 8.2 feet b.e.g.s. with water level at 4.5 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-S3

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 19, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 48.8 feet ± Project Datum
Weather	: Partly cloudy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 30

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 48.8 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
	20		SM	Yellow-orange, orange-brown, black fine SAND, little medium to coarse sand, trace gravel, trace silt (wet)		S-8	7-8-16	1.3			
30											
	15										
35											
	10										
40											
	5										
45											
	0										
50											
	-5										

NOTES:
1. Test boring terminated at ± 30.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 7.9 feet b.e.g.s.
4. Water elevation at 7.7 feet b.e.g.s. with augers at 8.5 feet b.e.g.s.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 30 feet b.e.g.s.
6. Borehole caved at approximately 8.2 feet b.e.g.s. with water level at 4.5 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
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TEST BORING TB-S4

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 15, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 15, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 49.5 feet ± Project Datum
Weather	: Overcast, 50's °F	Northing	: 0
Driller/Agency	: Dana/Feldmann Brothers, Inc.	Easting	: 10

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 49.5 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 12 inches)							
			SM	Orange-brown, dark brown fine SAND, little to trace medium sand, trace silt (moist)	☒	S-1	1-4-10	1.0			
				Orange-brown, dark brown fine SAND, little to trace medium sand, trace gravel, trace silt (moist)	☒	S-2A S-2B	10-4-2	1.5			
	45		ML	Gray, orange SILT, little fine sand, trace medium to coarse sand (moist)							
5											
				Varicolored (yellow-gray, gray, orange, black) fine SAND, little to some silt, trace medium to coarse sand, trace fine gravel (moist to wet)	☒	S-3	4-4-3	1.5			▼
	40			Orange, yellow, red-brown fine to medium SAND, little silt, trace coarse sand (wet)	☒	S-4	2-3-5	1.5			
10											
	35		SM	Yellow, white fine to medium SAND, little silt (wet)	☒	S-5	1/12"-2	1.5			
15											
	30			Gray, white, gray-yellow fine to medium SAND, little silt, little coarse sand, trace fine gravel (wet)	☒	S-6	2-2-4	1.5			
20											
	25			Varicolored (gray, orange, yellow-brown, white) fine to medium SAND, little silt, trace coarse sand (wet)	☒	S-7	2-3-5	1.5			
25											

NOTES:
1. Test boring terminated at ± 25.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-rod conditions observed at 8.2 feet b.e.g.s.
4. Water elevation at 8.1 feet b.e.g.s. with augers at 8.5 feet b.e.g.s.
5. Borehole caved at 8.6 feet b.e.g.s. with water level at 6.4 feet b.e.g.s. upon removal of augers.
6. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-S5

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 19, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 47.8 feet ± Project Datum
Weather	: Clear, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 40

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 47.8 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 13 inches)							
			ML	Gray, orange SILT and fine SAND, trace gravel (moist)	☒	S-1A S-1B	2-3-9	1.4			
	45			Gray, orange, red-brown fine SAND, little gravel, little medium to coarse sand, trace silt (moist)							
5				Brown, gray, orange, dark brown fine SAND, little silt, trace medium to coarse sand, trace gravel (moist)	☒	S-2	13-9-9	1.5			
	40			Orange, red-orange, yellow, gray, brown fine SAND, some silt, trace medium sand (moist)	☒	S-3	4-5-5	1.3	19.2	24.6	▼
10				Orange, red-gray fine SAND, little silt, trace gravel, trace medium to coarse sand (wet)	☒	S-4	2-4-3	1.4			
	35		SM	Yellow, white, orange-yellow fine SAND, little to some medium to coarse sand, little silt (wet)	☒	S-5	2-1-1	1.5	27.3	16.0	
15											
	30			Orange, yellow-orange, white, gray fine to medium SAND, little to some coarse sand, little to trace gravel, trace silt (wet)	☒	S-6	5-4-5	1.1			
20											
	25			Orange, yellow-gray, red-brown, brown fine SAND, little to some medium to coarse sand, trace to little silt (wet)	☒	S-7	3-4-6	1.5			
25											

NOTES:
1. Test boring terminated at ± 25.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 8.2 feet b.e.g.s.
4. Water elevation at 7.2 feet b.e.g.s. with augers at 8.5 feet b.e.g.s.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 25 feet b.e.g.s.
6. Borehole caved at 3.8 feet b.e.g.s. with water level at 3.8 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-S6

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 17, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 17, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 46.3 feet ± Project Datum
Weather	: Clear, Windy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 50

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 46.3 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 14 inches)							
	45		CL	Gray, dark gray, orange CLAY, little fine sand, trace gravel, trace organics (e.g., root material) (dry)	☒	S-1A S-1B	2-4-9	1.3			
				Gray, orange, white fine SAND, little silt, trace coarse sand, trace gravel (dry)							
				Gray, brown, orange-brown, white fine SAND, some silt, trace medium to coarse SAND (moist with depth)	☒	S-2	5-9-6	1.1			▼
5											
	40			Orange-brown, yellow-brown, red-brown, white fine to medium SAND, little silt, trace coarse sand, trace gravel (wet)	☒	S-3	1-2-1	1.3	24.1	13.7	
				Orange, gray-orange, white fine to medium SAND, little gravel, little to trace coarse sand, trace silt (wet)	☒	S-4	5-5-5	1.4			
10											
	35										
			SM	Orange, brown-orange, white fine to medium SAND, little coarse sand, trace gravel, trace silt (wet)	☒	S-5	4-4-3	1.4			
15											
	30										
				Orange, orange-brown, dark gray fine to medium SAND, some coarse sand, little silt, trace gravel (wet)	☒	S-6	2-4-4	1.5			
20											
	25										
				Orange, orange-brown, red-brown fine to medium SAND, little to some coarse sand, trace silt, trace gravel (wet)	☒	S-7	5-6-9	1.5			
25											
	20										

NOTES:
1. Test boring terminated at ± 25.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 5.0 feet b.e.g.s.
4. Water elevation at 4.6 feet b.e.g.s. with augers at 6.0 feet b.e.g.s.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 25 feet b.e.g.s.
7. Borehole dry and caved at 2.9 feet b.e.g.s. upon removal of augers.
8. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-S7

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 15, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 15, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 48.1 feet ± Project Datum
Weather	: Overcast, 50's °F	Northing	: 0
Driller/Agency	: Dana/Feldmann Brothers, Inc.	Easting	: 80

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 48.1 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 14 inches)							
				Brown, gray, orange fine SAND, little to some silt, trace gravel (moist)	☒	S-1	2-4-7	1.3			
	45			Brown, gray, orange, red-orange fine SAND, little to some silt, little to trace medium to coarse sand, trace gravel (moist)	☒	S-2	7-4-9	1.5			
5				Varicolored (red-brown, orange, yellow, black) fine to medium SAND, little silt, trace fine gravel (wet)	☒	S-3	4-5-4	1.5			▼
	40			Varicolored (yellow-orange, red-brown, dark gray) fine to medium SAND, little silt, trace coarse sand to fine gravel (wet)	☒	S-4	1-3-4	1.5			
10											
	35		SM	Orange-brown fine to medium SAND, little silt, little coarse sand to fine gravel (wet)	☒	S-5	1-2-1	1.5			
15											
	30			Orange-brown fine to medium SAND, some coarse sand, little to trace gravel, trace silt (wet)	☒	S-6	2-5-8	1.5			
20											
	25			Orange-brown, red-brown fine to medium SAND, little coarse sand, trace gravel, trace silt (wet)	☒	S-7	6-6-12	1.5			
25											

NOTES:
1. Test boring terminated at ± 25.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 4 feet b.e.g.s.
4. Water elevation at 6.6 feet b.e.g.s. with augers at 6.0 feet b.e.g.s. after obtaining sample S-3.
5. Approximately 4 inches of heave in borehole before obtaining sample S-6.
6. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-S8

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 17, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 17, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 47.2 feet ± Project Datum
Weather	: Clear, Windy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 70

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 47.2 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 12 inches)							
			CL	Dark gray, orange CLAY, little silt, some fine sand, trace organics (e.g., root material) (moist)	X	S-1A	1-6-10	1.3			
	45			Gray, dark gray, orange fine SAND, little silt, trace to little coarse sand, trace gravel (moist)	X	S-1B					
				Orange-brown, yellow-orange, brown, light gray fine SAND, trace silt (moist)	X	S-2	5-5-5	1.3			
5											▼
				Red-orange, orange fine to medium SAND, trace silt (wet)	X	S-3	4-5-3	1.4			
	40										
				Orange-brown, orange, yellow-orange, brown fine SAND, little medium to coarse sand, little silt, trace gravel (wet)	X	S-4	2-3-5	1.5	22.7	12.5	
10											
	35										
			SM	Orange-brown, orange, yellow-orange, brown fine SAND, little medium to coarse sand, trace gravel, trace silt (wet)	X	S-5	3-3-4	1.5			
15											
	30										
				Yellow-brown, orange-brown, red-orange, red-brown fine to medium SAND, little to some silt, little coarse sand, trace gravel (wet)	X	S-6	2-2-4	1.5			
20											
	25										
				Orange, yellow-orange, white, red-brown fine SAND, some medium to coarse sand, little silt, trace gravel (wet)	X	S-7	3-3-5	1.5			
25											

NOTES:
1. Test boring terminated at ± 25.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-rod conditions observed at 5.3 feet b.e.g.s.
4. Water elevation at 5.5 feet b.e.g.s. with augers at 6.0 feet b.e.g.s.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 25 feet b.e.g.s.
6. Borehole caved at 3.3 feet b.e.g.s. with water level at approximately 2.9 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-S9

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 18, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 18, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 47.5 feet ± Project Datum
Weather	: Partly cloudy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 60

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 47.5 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 14 inches)							
			CL	Gray, orange CLAY, some fine sand, little silt (moist)	X	S-1A	2-2-7	1.5			
	45			Gray, white fine SAND, little silt, trace medium to coarse sand (moist)		S-1B					
5				Light gray, gray, orange-brown, gray-brown, white fine SAND, some medium to coarse sand, trace silt (moist)	X	S-2	12-21-26	1.4			
	40			Orange, yellow-orange, gray, gray-brown fine SAND, little silt, little medium sand (moist to wet)	X	S-3	5-5-4	1.5			▼
10				Orange, gray-brown fine SAND, little to some silt, little to trace medium sand (wet)	X	S-4	3-2-4	1.5			
	35										
15			SM	Orange, yellow-orange, red-brown, black fine SAND, little silt, trace to little medium to coarse sand, trace gravel (wet)	X	S-5	1-1-2	1.5	27.3	17.7	
	30										
20				Orange-brown, yellow-orange, red-brown, green-gray fine to medium SAND, trace to little coarse sand, trace gravel, trace silt (wet)	X	S-6	3-5-5	1.3			
	25										
25				Orange, white, red-brown, dark gray fine to medium SAND, little to some coarse sand, little gravel, trace silt (wet)	X	S-7	3-4-6	1.4			

NOTES:
1. Test boring terminated at ± 50.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 6.0 feet b.e.g.s.
4. Water elevation at 6.7 feet b.e.g.s. with augers at 6.0 feet b.e.g.s. after obtaining sample S-3.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 50 feet b.e.g.s.
6. Borehole caved at 3.1 feet b.e.g.s. with water level at approximately 2.5 feet b.e.g.s. upon removal of augers.
7. Bore

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TEST BORING TB-S9

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 18, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 18, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 47.5 feet ± Project Datum
Weather	: Partly cloudy, 40's °F	Northing	: 0
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.	Easting	: 60

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 47.5 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
	20		SM	Orange, dark brown, white, red-brown fine SAND, little to some medium to coarse sand, trace gravel, trace silt (wet)	X	S-8	4-3-6	1.4			
30											
	15			Orange-brown, yellow-orange, red-brown, black, yellow, white fine to coarse SAND, some silt, some gravel (wet)	X	S-9	5-22-42	1.3			
35											
	10		ML	Dark gray SILT, trace fine sand (moist); LIQUID LIMIT = 48, PLASTICITY INDEX = 14	X	S-10	4-5-6	1.5	44.0	97.0	
40											
	5			Dark gray SILT, some fine sand (moist)	X	S-11	3-2-6	1.5			
45											
	0		SM	Dark gray, black, white, orange fine SAND, some silt, trace medium to coarse sand (wet)	X	S-12	4-6-9	1.5			
50											
	-5										

NOTES:
1. Test boring terminated at ± 50.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 6.0 feet b.e.g.s.
4. Water elevation at 6.7 feet b.e.g.s. with augers at 6.0 feet b.e.g.s. after obtaining sample S-3.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 50 feet b.e.g.s.
6. Borehole caved at 3.1 feet b.e.g.s. with water level at approximately 2.5 feet b.e.g.s. upon removal of augers.
7. Bore

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TEST BORING TB-S10

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 15, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 15, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 47.3 feet ± Project Datum
Weather	: Overcast, 50's °F	Northing	: 0
Driller/Agency	: Dana/Feldmann Brothers, Inc.	Easting	: 90

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 47.3 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 12 inches)							
			CL	Dark gray, orange silty CLAY, little fine sand (dry)	⊠	S-1A	2-7-14	1.3			
	45			Light gray, dark gray fine SAND, trace to little medium to coarse sand, little silt, trace gravel (dry)		S-1B					
				White-gray, gray, orange fine SAND, little to some silt, trace medium to coarse sand, trace gravel (moist)	⊠	S-2	4-3-2	1.3			
5											
				Varicolored (yellow, orange-yellow, red-brown, yellow-gray) fine to medium SAND, trace silt, trace coarse sand to fine gravel (wet)	⊠	S-3	2-1-1	1.4			▼
	40										
				Orange, orange-brown fine to medium SAND, little to some silt, little to trace coarse sand (wet)	⊠	S-4	1-1-2	1.5			
10											
	35										
			SM	Orange fine to medium SAND, little silt, little to trace coarse sand to fine gravel (wet)	⊠	S-5	1-2-3	1.5			
15											
	30										
				Yellow-orange, red-orange fine to medium SAND, little to some silt (wet)	⊠	S-6	1-2-6	1.5			
20											
	25										
				Orange, dark orange, orange-yellow fine to medium SAND, little silt (wet)	⊠	S-7	3-6-10	1.5			
25											

NOTES:
1. Test boring terminated at ± 25.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-rod conditions observed at 7 feet b.e.g.s.
4. Water elevation at 6.9 feet b.e.g.s. with augers at 8.5 feet b.e.g.s.
5. Borehole caved at 8.1 feet b.e.g.s. with water level at 6.8 feet b.e.g.s. upon removal of augers.
6. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-R1

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 15, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 15, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 46 feet ± Project Datum
Weather	: Overcast, 50's °F		
Driller/Agency	: Dana/Feldmann Brothers, Inc.		

Sample Condition: ⊠ Remolded

Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 46 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 12 inches)							
	45		SM	Brown, orange-brown, gray-brown fine SAND, little to some medium to coarse sand, little silt, trace fine gravel (moist)	⊠	S-1	2-4-5	1.3			
				Varicolored (gray, orange, red-brown) fine SAND, little medium to coarse sand, trace silt (moist)	⊠	S-2	3-2-1	1.3			
5											▼
	40			Orange-brown, red-brown, black fine SAND, little medium sand, trace coarse sand, trace silt, trace gravel (wet)	⊠	S-3	3-3-5	1.5			
				Brown, orange-brown, red-brown, black fine to medium SAND, little to trace coarse sand to fine gravel, trace silt (wet)	⊠	S-4	5-5-5	1.5			
10											
	35										
15											
	30										
20											
	25										
25											
	20										

NOTES:
1. Test boring terminated at ± 10.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 5.2 feet b.e.g.s.
4. Water elevation at 5.7 feet b.e.g.s. with augers at 6.0 feet b.e.g.s.
5. Borehole caved at 5.2 feet b.e.g.s. with water level at 4.8 feet b.e.g.s. upon removal of augers.
6. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-R2

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 19, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 46.6 feet ± Project Datum
Weather	: Clear, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ☒ Remolded

Water Levels

Depth in feet	Surf. Elev. 46.6 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 9 inches)							
	45		SM	Orange-brown fine SAND, little silt (moist)	☒	S-1	2-5-9	0.2			
5				Orange-brown, gray, red-brown fine SAND, little medium to coarse sand, trace silt (moist)	☒	S-2	4-6-6	1.4			
	40										
10											
	35										
15											
	30										
20											
	25										
25											
	20										

NOTES:
1. Test boring terminated at ± 5.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. No groundwater encountered during drilling.
4. Borehole dry and caved at 2.7 feet b.e.g.s. upon removal of augers.
5. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-R3

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 15, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 15, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 48.7 feet ± Project Datum
Weather	: Overcast, 50's °F		
Driller/Agency	: Dana/Feldmann Brothers, Inc.		

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 48.7 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 12 inches)							
			SM	Brown, orange-brown fine SAND, little silt, little medium to coarse sand, trace gravel (moist)	☒	S-1	2-3-6	1.3			
	45			Brown, orange-brown, black, white fine to medium SAND, little silt, little coarse sand, trace gravel (moist)	☒	S-2	7-8-9	1.4			
5				Orange-brown, yellow-gray, white fine to medium SAND, little silt, trace coarse sand, trace gravel (wet)	☒	S-3	5-6-7	1.3			▼
	40			Varicolored (orange-brown, yellow, black, gray) fine to medium SAND, little to some coarse sand, little silt, trace gravel (wet)	☒	S-4	3-3-4	1.3			
10											
	35										
15											
	30										
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 10.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 5.2 feet b.e.g.s.
4. Water elevation at 6.4 feet b.e.g.s. with augers at 6.0 feet b.e.g.s. after obtaining sample S-3.
5. Borehole caved at 6.6 feet b.e.g.s. with water level at 5.2 feet b.e.g.s. upon removal of augers.
6. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-R4

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 19, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 49.6 feet ± Project Datum
Weather	: Clear, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ☒ Remolded

Water Levels

Depth in feet	Surf. Elev. 49.6 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 12 inches)							
			SM	Orange-brown, white fine SAND and SILT, trace gravel (moist)	☒	S-1	2-3-4	1.3	14.7	46.1	
	45			Orange-brown, orange, red-orange, yellow-gray, dark brown fine SAND, trace silt, trace medium to coarse sand (moist)	☒	S-2	6-5-9	1.5			
5											
	40										
10											
	35										
15											
	30										
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 5.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. No groundwater encountered during drilling.
4. Borehole dry and caved at 2.1 feet b.e.g.s. upon removal of augers.
5. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-R5

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 17, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 17, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 47.9 feet ± Project Datum
Weather	: Clear, Windy, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 47.9 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 13 inches)							
			ML	Gray, orange clayey SILT, little fine sand	☒	S-1A S-1B	3-3-10	1.2			
	45		SM	Gray, orange fine SAND, little to some gravel, trace medium to coarse sand, trace silt (moist)							
5				Gray, orange-brown, red-brown fine SAND, little silt, trace gravel, trace medium to coarse sand (moist)	☒	S-2	6-8-7	1.5			▼
				Varicolored (Brown, gray, white, orange-brown) fine to medium SAND, little gravel, trace coarse sand, trace silt (moist to wet)	☒	S-3	6-7-7	1.2			
	40			Varicolored (Brown, orange-brown, red-brown, white, yellow) fine to medium SAND, trace to little coarse sand, trace silt, trace gravel (wet)	☒	S-4	3-5-5	1.3			
10											
	35										
15											
	30										
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 10.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-rod conditions observed at 6.9 feet b.e.g.s.
4. Water elevation at 5.9 feet b.e.g.s. with augers at 8.5 feet b.e.g.s.
5. Borehole wet and caved at 4.1 feet b.e.g.s. upon removal of augers.
6. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-R6

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 19, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 49.6 feet ± Project Datum
Weather	: Clear, 40°s		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ☒ Remolded

Water Levels

Depth in feet	Surf. Elev. 49.6 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 10 inches)							
			SM	Orange-brown fine SAND, trace gravel, trace silt (moist)	☒	S-1	6-12-12	1.1			
	45			Orange-brown, white fine SAND, some gravel, little medium to coarse sand, trace silt (moist)	☒	S-2	6-10-8	1.2			
5											
	40										
10											
	35										
15											
	30										
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 5.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. No groundwater encountered during drilling.
4. Borehole dry and caved at 1.5 feet b.e.g.s. upon removal of augers.
5. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-B1

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 22, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 22, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 45.4 feet ± Project Datum
Weather	: Foggy, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 45.4 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0	45		SM	TOPSOIL (± 5 inches) Gray, orange fine SAND, trace medium to coarse sand, trace silt, trace gravel (moist)	⊠	S-1A S-1B	2-3-3	1.1			
			ML	Gray, orange SILT, little gravel, trace fine sand (moist)							
5	40		SM	Light gray, gray, orange-brown, white fine SAND, some medium to coarse sand, little silt, trace gravel (moist to wet)	⊠	S-2	5-4-4	1.3			▼
				Orange, yellow, yellow-gray, dark brown fine SAND, little to some medium to coarse sand, little clay (wet)	⊠	S-3	3-4-4	1.3			
10	35			Orange-brown, red-brown, yellow-brown, black fine SAND, little silt, trace gravel, trace medium to coarse sand (wet)	⊠	S-4	2-1-3	1.5			
15	30			Orange, orange-brown, red-brown, yellow-orange fine SAND, some medium to coarse sand, little to trace silt, trace gravel (wet)	⊠	S-5	4-4-6	1.4			
20	25										
25	20										

NOTES:
1. Test boring terminated at ± 15.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-rod conditions observed at 4.7 feet b.e.g.s.
4. Water elevation at 4.7 feet b.e.g.s. during drilling.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 15 feet b.e.g.s.
6. Borehole caved at 3.6 feet b.e.g.s. with water level at 3.3 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-B2

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 22, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 22, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 47.5 feet ± Project Datum
Weather	: Partly cloudy, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 47.5 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 12 inches)							
			ML	Gray, orange SILT, some fine sand, little medium to coarse sand, trace gravel (moist)	⊠	S-1A S-1B	1-3-9	1.4			
	45		SM	Orange, gray, white fine to medium SAND, little to some coarse sand, little gravel, trace silt (moist)							
5				Gray, orange-brown, red-brown, white fine SAND, some medium to coarse sand, little gravel, trace silt (moist)	⊠	S-2	4-3-6	1.1			
	40			Varicolored (light gray, orange-brown, yellow-brown, white) fine to medium SAND, trace coarse sand, trace gravel, trace silt (wet)	⊠	S-3	1-3-1	0.9			▼
10				Yellow-gray, orange-brown, white fine SAND, trace to little silt (wet)	⊠	S-4	2-1-2	1.5			
	35			Orange, yellow-orange, red-brown, white fine SAND, little silt, little gravel, little medium to coarse sand (wet)	⊠	S-5	3-2-3	1.4			
15											
	30			Orange-brown, black, white, red-brown fine to medium SAND, some to and coarse sand, trace silt (wet)	⊠	S-6	6-5-8	1.3			
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 5.0 feet b.e.g.s.
4. Water elevation at 5.8 feet b.e.g.s. during drilling.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 20 feet b.e.g.s.
6. Borehole wet and caved at 4.9 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-B3

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 22, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 22, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 47.9 feet ± Project Datum
Weather	: Partly cloudy, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 47.9 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 11 inches)							
			ML	Gray, orange-brown SILT, little to some fine sand (moist)	☒	S-1A S-1B	3-4-11	1.4			
	45		SM	Gray, orange, orange-brown, black fine SAND, trace medium to coarse sand, trace gravel, trace silt (moist)							
5				Orange-brown, yellow-gray, gray fine SAND, little to some medium to coarse sand, trace gravel, trace silt (moist)	☒	S-2	7-7-7	1.4			▼
				Orange-brown, red-brown, light gray fine SAND, little silt, trace medium to coarse sand (wet)	☒	S-3	2-3-5	1.4			
	40			Orange-brown, red-brown fine SAND, trace gravel, trace medium to coarse sand, trace silt (wet)	☒	S-4	3-3-4	1.5			
10											
	35			Orange-brown fine to medium SAND, little coarse sand, trace gravel, trace silt (wet)	☒	S-5	4-4-4	1.4			
15											
	30										
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 15.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-rod conditions observed at 5.5 feet b.e.g.s.
4. Water elevation at 5.7 feet b.e.g.s. during drilling.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 15 feet b.e.g.s.
6. Borehole caved at 4.2 feet b.e.g.s. with water level at 3.3 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST BORING TB-B4

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 19, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 22, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 50.9 feet ± Project Datum
Weather	: Partly cloudy, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: Remolded
Water Levels: During Drilling

Depth in feet	Surf. Elev. 50.9 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 9 inches)							
	50		ML	Brown, orange-brown SILT and fine SAND (moist)	X	S-1	2-2-3	1.3	16.6	58.2	
				Gray, orange-brown SILT, little to some fine sand (moist)	X	S-2A S-2B	5-13-5	1.5			▼
5	45		SM	Orange-brown, brown, white fine SAND, little silt, trace medium to coarse sand, trace gravel (moist)							
				Orange-brown, dark brown fine SAND, trace silt, trace medium to coarse sand (moist to wet)	X	S-3	5-6-3	1.2			
10	40			Orange-brown, yellow-white, red-brown fine SAND, trace gravel, trace silt, trace medium to coarse sand (wet)	X	S-4	1-2-3	1.2			
15	35			Orange-brown, red-brown, black fine SAND, little gravel, little medium to coarse sand, trace silt (wet)	X	S-5	2-2-7	1.5			
20	30			Orange-brown, red-brown, black, yellow fine SAND, some medium to coarse sand, little silt, trace gravel (wet)	X	S-6	5-6-5	1.5			
25	25										

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 5.0 feet b.e.g.s.
4. Water elevation at 4.6 feet b.e.g.s. during drilling.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 20 feet b.e.g.s.
6. Borehole caved at 6.8 feet b.e.g.s. with water level at 6.7 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-B5

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 22, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 22, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 50.3 feet ± Project Datum
Weather	: Clear, 50's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 50.3 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0	50			TOPSOIL (± 12 inches)							
			ML	Brown, orange-brown, orange SILT, little to some fine sand, trace coarse sand (moist)	⊠	S-1	1-1-2	1.4			
5	45		SM	Orange-brown, brown, white fine SAND, little gravel, little medium to coarse sand, trace silt (moist)	⊠	S-2	11-12-14	1.4			
				Orange-brown, gray, yellow, orange-yellow fine SAND, little silt, trace gravel (moist to wet)	⊠	S-3	4-4-4	1.3			▼
10	40			Orange-brown, red-orange fine SAND, trace silt, trace medium to coarse sand (wet)	⊠	S-4	3-3-6	1.5			
15	35			Orange-brown, red-brown, black-brown fine SAND, trace gravel, trace medium to coarse sand, trace silt (wet)	⊠	S-5	3-3-5	1.5			
20	30										
25	25										

NOTES:
1. Test boring terminated at ± 15.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 7.3 feet b.e.g.s.
4. Water elevation at 7.5 feet b.e.g.s. during drilling.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 15 feet b.e.g.s.
6. Borehole wet and caved at 5.7 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-B6

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 23, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 23, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 48.0 feet ± Project Datum
Weather	: Clear, 50's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 48.0 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (±13 inches)							
			ML	Gray, dark gray, orange SILT, some fine sand (moist)	⊠	S-1A	2-3-5	1.4			
				Gray, dark gray, orange fine SAND, little silt (moist)		S-1B					
	45										
				Light gray, gray, white fine SAND, little to some gravel, little medium to coarse sand, trace silt (moist)	⊠	S-2	1-6-7	1.5			
5											
				Orange-brown, gray fine SAND, little silt, trace medium to coarse sand, trace gravel (wet)	⊠	S-3	4-4-3	1.4			▼
	40										
				Orange-brown, red-brown fine SAND, trace to little silt, trace medium to coarse sand, trace gravel (wet)	⊠	S-4	1-3-3	1.5			
10			SM								
	35										
				Orange-brown, red-brown fine SAND, little silt, trace medium to coarse sand, trace gravel (wet)	⊠	S-5	2-1-2	1.5			
15											
	30										
				Orange-brown, red-brown, black fine SAND, little to some gravel, trace silt, trace medium to coarse sand (wet)	⊠	S-6	4-4-4	1.4			
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 6.0 feet b.e.g.s.
4. Water elevation at 6.3 feet b.e.g.s. during drilling.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 20 feet b.e.g.s.
6. Borehole caved at 6.4 feet b.e.g.s. with water level at 3.8 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-B7

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 22, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 22, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 48.5 feet ± Project Datum
Weather	: Clear, 50's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 48.5 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 8 inches)							
			SM	Gray, orange fine SAND, some silt (moist)	☒	S-1	3-3-3	1.2			
	45			Orange-brown, gray, red-brown, white fine SAND, some gravel, little silt, little to trace medium to coarse sand (moist)	☒	S-2	4-5-8	1.4			
5				Orange-brown, red-brown, yellow-brown, white fine SAND, little silt, little medium to coarse sand, trace gravel (wet)	☒	S-3	3-5-4	1.5			▼
	40			Orange-brown, yellow-brown, red-brown fine SAND, little silt, little medium to coarse sand, trace gravel (wet)	☒	S-4	3-4-7	1.5			
10											
	35			Orange-brown, red-brown fine to medium SAND, little to some coarse sand, little gravel, trace silt (wet)	☒	S-5	3-2-4	1.5			
15											
	30										
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 15.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 6.0 feet b.e.g.s.
4. Water elevation at 5.9 feet b.e.g.s. during drilling.
5. Drilling methods were Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 15 feet b.e.g.s.
6. Borehole caved at 5.0 feet b.e.g.s. with water level at 4.7 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-B8

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 23, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 23, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 53.0 feet ± Project Datum
Weather	: Clear, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ☒ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 53.0 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 7 inches)							
			ML	Brown SILT, little to some fine sand (moist)							
				Brown fine SAND, little medium to coarse sand, trace silt (moist)	☒	S-1A S-1B	2-3-3	1.4			
	50										
5				Brown, yellow-brown, red-brown, white fine SAND, some medium to coarse sand, trace gravel, trace silt (moist)	☒	S-2	3-5-5	1.5			
				Orange-brown, gray, red-gray, white fine SAND, some medium sand, trace coarse sand, trace gravel, trace silt (moist)	☒	S-3	6-10-10	1.5			
	45										
10				Varicolored (yellow-brown, gray, red-brown, white) fine SAND, little gravel, little medium to coarse sand, trace silt (moist to wet)	☒	S-4	4-3-4	1.4			▼
			SM								
	40										
15				Yellow-brown, orange-brown, red-brown, gray-brown fine to medium SAND, little to some gravel, little coarse sand, trace to little silt (wet)	☒	S-5	3-3-3	1.5			
	35										
20				Orange-brown, red-brown, gray, black fine SAND, some to and medium to coarse sand, little gravel, little to trace silt (wet)	☒	S-6	3-2-3				
	30										
25											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 8.8 feet b.e.g.s.
4. Water elevation at 9.9 feet b.e.g.s. with augers at 8.5 feet b.e.g.s. after obtaining sample S-4.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 20 feet b.e.g.s.
6. Borehole caved at 7.3 feet b.e.g.s. with water level at 6.8 feet b.e.g.s. upon removal of augers.
7. Bore

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TEST BORING TB-B9

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 23, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 23, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 49.4 feet ± Project Datum
Weather	: Clear, 50's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 49.4 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 14 inches)							
			SM	Gray, orange, orange-brown, yellow-orange fine SAND and SILT, trace gravel, trace medium to coarse sand (moist)	⊠	S-1	3-2-3	1.5			
	45			Gray, light gray, orange-brown, red-brown, white fine SAND, trace medium to coarse sand, trace silt (moist)	⊠	S-2	3-4-5	1.5			
5				Gray, yellow-gray, orange-brown, red-brown, white fine SAND, some medium to coarse sand, little gravel, little to trace silt (wet)	⊠	S-3	3-3-2	1.5			▼
	40			Orange, orange-brown, red-brown, gray fine SAND, little silt, trace gravel, trace medium to coarse sand (wet)	⊠	S-4	2-1-2	1.5			
10											
	35			Light orange-brown, black fine SAND, some silt (wet)	⊠	S-5	1-2-1	1.5			
15											
	30			Light orange-brown, black fine SAND, some silt (wet)	⊠	S-6	2-1-3	1.5			
20											
	25										
25											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 5.5 feet b.e.g.s.
4. Water elevation at 7.9 feet b.e.g.s. during drilling.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 20 feet b.e.g.s.
6. Borehole caved at 6.8 feet b.e.g.s. with water level at 5.2 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-B10

Capital School District
Dover High School
Dover, DE
Project No. 7158.GC

Date Started	: November 23, 2010	Drilling Equipment	: ATV Mounted Diedrich D-50
Date Completed	: November 23, 2010	Drilling Methods	: HSA (SPT, ASTM D 1586)
Logged by	: ARS	Surface Elevation	: 51.7 feet ± Project Datum
Weather	: Partly cloudy, 40's °F		
Driller/Agency	: Wayne Proud/Feldmann Brothers, Inc.		

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Surf. Elev. 51.7 ft	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				TOPSOIL (± 13 inches)							
	50		SM	Red-brown, orange-brown, gray fine SAND, trace medium to coarse sand, trace gravel, trace silt (moist)	⊠	S-1	2-2-4	1.4			
5				Orange-brown, gray, red-orange, light brown fine SAND, trace medium to coarse sand, trace silt (moist)	⊠	S-2	3-3-4	1.3			
	45			Yellow-brown, gray, orange-brown, red-brown, white fine SAND, little to trace silt (moist)	⊠	S-3	2-4-5	1.5			
10				Gray, yellow-brown, orange, white fine SAND, trace gravel, trace medium to coarse sand, trace silt (moist to wet)	⊠	S-4	1-1-1	1.3			▼
	40										
15				Yellow-brown, orange-brown, red-brown, white fine SAND, little to some medium to coarse sand, trace silt (wet)	⊠	S-5	2-2-2	1.5			
	35										
20											
	30										
25											
	25										

NOTES:
1. Test boring terminated at ± 15.0 feet b.e.g.s. (below existing ground surface).
2. Ground surface elevations estimated based on drawing titled "Boring Locations - As Staked 2010-10-29," prepared by Becker Morgan Group, dated October 21, 2010.
3. Wet-on-spoon conditions observed at 8.0 feet b.e.g.s.
4. Water elevation at 9.0 feet b.e.g.s. during drilling.
5. Drilling methods utilized: Hollow Stem Augers from 0 to 10 feet b.e.g.s. and mud rotary from 10 to 15 feet b.e.g.s.
6. Borehole caved at 5.6 feet b.e.g.s. with water level at 4.1 feet b.e.g.s. upon removal of augers.
7. Borehole backfilled with soil cuttings upon completion.

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TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 3, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
TP-1	0 – 0.7	TOPSOIL
(Elev. 46.2 feet)	0.7 – 2.0 Sample No. 1 @ 1.5'	Light brown SILT, little fine sand (moist, medium stiff consistency)
	2.0 – 4.0 Sample No. 2 @ 3'	Orange-brown fine SAND, some silty clay, trace medium sand (moist, medium density, slightly plastic)
	4.0 – – – Sample No. 3 @ 6'	Light brown fine to medium SAND, trace to little clay, trace rounded gravel (wet, medium density, plastic, mottled at 4 feet)

NOTES:

(1) Test pit excavated by Feldmann Brothers, Inc. personnel utilizing a rubber tired backhoe.
(2) Ground surface elevations estimated based on grade marks provided on a drawing titled, "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," dated October 21, 2010, prepared by Becker Morgan Group.
(3) Test pit terminated approximately 12 feet below the existing ground surface (b.e.g.s.).
(4) Moderate groundwater seepage was observed in the test pit at a depth of 6 feet b.e.g.s.
(5) Seasonal high water table estimated to be approximately 4 ft b.e.g.s. based on observed redoximorphic features.
(6) Extensive sidewall caving was observed during the excavation of the test pit below 6 feet b.e.g.s. then below 2 ft b.e.g.s. after completion of the test pit.
(7) Test pit caved and dry at 6 feet b.e.g.s. upon completion due to sidewall caving.
(8) Test pit backfilled with excavated soils upon completion.
(9) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

DUFFIELD ASSOCIATES
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TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 3, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
TP-2	0 – 1.1	TOPSOIL
(Elev. 46.4 feet)	1.1 – 2.0 Sample No. 1 @ 1.5'	Light brown, light gray-brown silty CLAY, trace fine sand (moist, medium stiff consistency)
	2.0 – – – Sample No. 2 @ 2.5' Sample No. 3 @ 5.5'	Light brown, orange-brown, light gray fine to medium SAND, trace to little clay, trace rounded gravel (moist to wet, medium to loose density, plastic, mottled at 4 feet)

NOTES:

(1) Test pit excavated by Feldmann Brothers, Inc. personnel utilizing a rubber tired backhoe.
(2) Ground surface elevations estimated based on grade marks provided on a drawing titled, "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," dated October 21, 2010, prepared by Becker Morgan Group.
(3) Test pit terminated approximately 11 feet below the existing ground surface (b.e.g.s.).
(4) Rapid groundwater seepage was observed in the test pit at a depth of 5 feet b.e.g.s.
(5) Seasonal high water table estimated to be approximately 4 ft b.e.g.s. based on observed redoximorphic features.
(6) Extensive sidewall caving was observed during the excavation of the test pit below 6 feet b.e.g.s.
(7) Test pit caved at 8 feet b.e.g.s. with water level at 8 feet b.e.g.s. upon completion.
(8) Test pit backfilled with excavated soils upon completion.
(9) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

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TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 3, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
TP-3	0 – 0.8	TOPSOIL
(Elev. 51.7 feet)	0.8 – 3.0 Sample No. 1 @ 3'	Brown, light gray-brown, light brown, mottled clayey SILT, little to some fine sand (moist, medium consistency)
	3.0 – – – Sample No. 2 @ 4.5' Sample No. 3 @ 8.5' Sample No. 4 @ 9' Sample No. 5 @ 12'	Light gray, light brown fine SAND, little to trace clay, trace medium sand, trace rounded gravel (moist to wet, medium to loose density, mottled at 4 feet, plastic)

NOTES:

(1) Test pit excavated by Feldmann Brothers, Inc. personnel utilizing a rubber tired backhoe.
(2) Ground surface elevations estimated based on grade marks provided on a drawing titled, "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," dated October 21, 2010, prepared by Becker Morgan Group.
(3) Test pit terminated approximately 13 feet below the existing ground surface (b.e.g.s.).
(4) Moderate groundwater seepage was observed in the test pit at a depth of 8.5 feet b.e.g.s.
(5) Seasonal high water table estimated to be approximately 3.5 ft b.e.g.s. based on observed redoximorphic features.
(6) Moderate sidewall caving was observed during the excavation of the test pit below 8.5 feet b.e.g.s.
(7) Test pit caved and dry at 12 feet b.e.g.s. upon completion.
(8) Test pit backfilled with excavated soils upon completion.
(9) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

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Consultants in the Geosciences

TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 3, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
TP-4	0 – 0.9	TOPSOIL
(Elev. 51.4 feet)	0.9 – 4.0 Sample No. 1 @ 2.5'	Brown, orange-brown, light brown fine SAND, little clay, trace medium sand (moist, loose to medium density, plastic)
	4.0 – 8.0 Sample No. 2 @ 4.5'	Light brown fine SAND, trace clay, trace medium sand (moist, loose density, slightly plastic, slightly mottled at 4 to 4.5 feet)
	8.0 – – – Sample No. 3 @ 8' Sample No. 4 @ 12.5'	Light gray, yellow-brown, fine SAND, trace clay, trace medium sand lenses, trace rounded gravel (moist to wet, loose to medium density, mottled from 8 to 9 feet, plastic)

NOTES:

(1) Test pit excavated by Feldmann Brothers, Inc. personnel utilizing a rubber tired backhoe.
(2) Ground surface elevations estimated based on grade marks on a drawing titled, "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," dated October 21, 2010, prepared by Becker Morgan Group.
(3) Test pit terminated approximately 14 feet below the existing ground surface (b.e.g.s.).
(4) Moderate groundwater seepage was observed in the test pit at a depth of 10.5 feet b.e.g.s.
(5) Seasonal high water table estimated to be approximately 4.5 ft b.e.g.s. based on observed redoximorphic features.
(6) Extensive sidewall caving was observed during the excavation of the test pit below 7 feet b.e.g.s. then below 2 ft b.e.g.s. after completion of the test pit.
(7) Test pit caved at 12 feet b.e.g.s. with water level at 11.5 feet b.e.g.s. upon completion.
(8) Test pit backfilled with excavated soils upon completion.
(9) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

DUFFIELD ASSOCIATES
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TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 3, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
TP-5	0 – 1.0	TOPSOIL
(Elev. 53.3 feet)	1.0 – 3.0 Sample No. 1 @ 2'	Brown fine SAND and clayey silt, trace medium sand (moist, medium density, slightly plastic)
	3.0 – 5.0 Sample No. 2 @ 4'	Brown fine SAND, little clayey silt, trace medium sand (moist, loose to medium density, slightly plastic)
	5.0 – – – Sample No. 3 @ 7' Sample No. 4 @ 9.5' Sample No. 5 @ 14'	Light gray, brown, light brown, fine SAND, trace clay, trace medium sand, trace rounded gravel (moist to wet, loose to medium density, slightly mottled at 7.5 feet, slightly plastic)

NOTES:

(1) Test pit excavated by Feldmann Brothers, Inc. personnel utilizing a rubber tired backhoe.
(2) Ground surface elevations estimated based on grade marks on a drawing titled, "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," dated October 21, 2010, prepared by Becker Morgan Group.
(3) Test pit terminated approximately 14.5 feet below the existing ground surface (b.e.g.s.).
(4) Moderate groundwater seepage was observed in the test pit at a depth of 11.5 feet b.e.g.s.
(5) Seasonal high water table estimated to be approximately 7.5 ft b.e.g.s. based on observed redoximorphic features.
(6) Moderate sidewall caving was observed during the excavation of the test pit below 8.5 feet b.e.g.s.
(7) Test pit caved at 11.5 feet b.e.g.s. with water level at 11.3 feet b.e.g.s. 1 hour after completion.
(8) Test pit backfilled with excavated soils upon completion.
(9) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST PIT DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 9, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
I-1A	0 – 1.0	TOPSOIL
(Elev. 43.7 feet)	1.0 – 2.4 Sample No. 1 @ 1.5'	Light gray, dark gray silty CLAY, trace fine sand, trace organics (e.g., root material) (medium stiff consistency, moist)
	2.4 – – – Sample No. 2 @ 3.0'	Light gray, orange-brown, yellow-brown fine SAND, little to trace clayey silt (medium dense, wet)

NOTES:

(1) Test pit excavated by Feldmann Brothers' personnel utilizing a rubber tired backhoe.
(2) Ground surface elevations provided on a drawing titled "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," prepared by the Becker Morgan Group, dated October 21, 2010.
(3) Test pit terminated approximately 4.0 feet below the existing ground surface (b.e.g.s.).
(4) Moderate groundwater seepage was observed in the test pit at a depth of 3.5 ft b.e.g.s. during excavation.
(5) Slight sidewall caving of excavation side walls observed from approximately 3.0 feet b.e.g.s., 0.5 hours after completion of excavation.
(6) Water level at 3.6 feet b.e.g.s., bottom of excavation at 3.9 ft. b.e.g.s., 1 hour after completion of excavation.
(7) Seasonal high water table estimated to be approximately 1 ft b.e.g.s. based on observed redoximorphic features.
(8) Test pit backfilled with excavated soils upon completion.
(9) Test pit offset approximately 30 ft northeast after obstructing a terracotta pipe (apparent field drainage pipe) approximately 2.5 ft b.e.g.s. at staked location.
(10) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 9, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
I-2	0 – 0.5	TOPSOIL
(Elev. 45.0 feet)	0.5 – 2.5 Sample No. 1A @ 1.5' Sample No. 2A @ 1.6'	Light gray, orange-brown clayey SILT (mottled), some fine sand (stiff consistency, moist) Lab results for sample S-2A • Moisture: 15% • Percent passing No. 270 sieve: 76% • USDA: Silty Loam • USCS: ML
	2.5 – 4.7 Sample No. 2 @ 3.5'	Light gray fine SAND, trace to little medium sand, trace silty clay, trace rounded gravel (loose to medium dense, moist to wet)
	4.7 – – – Sample No. 3 @ 5.5'	Orange-brown, light gray, yellow-brown fine SAND (mottled), little medium sand, trace to little gravel, trace clay (medium dense, wet)

NOTES:

1) Test pit excavated by Feldmann Brothers' personnel utilizing a rubber tired backhoe.
2) Ground surface elevations provided on a drawing titled "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," prepared by the Becker Morgan Group, dated October 21, 2010.
3) Test pit terminated approximately 7.0 feet below the existing ground surface (b.e.g.s.).
4) Rapid groundwater seepage was observed in the test pit at a depth of 6.0 ft b.e.g.s. during excavation.
5) Moderate sidewall caving of excavation side walls observed from approximately 3.0 to 6.0 feet b.e.g.s., 0 to 1 hours after completion of excavation.
6) Water level at 2.8 feet b.e.g.s., 0 to 1 hour after completion of excavation.
7) Seasonal high water table estimated to be approximately 0.5 ft b.e.g.s. based on observed redoximorphic features.
8) Single ring infiltration test performed at approximately 1.5 feet b.e.g.s.
9) Test pit backfilled with excavated soils upon completion.
10) Terracotta pipe (apparent field drainage pipe) obstructed approximately 2 ft b.e.g.s. at staked location.
11) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 9, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
I-3	0 – 0.6	TOPSOIL
(Elev. 47.0 feet)	0.6 – 2.6 Sample No. 1 @ 0.6'	Gray-brown, orange-brown silty CLAY (slightly mottled), little fine sand (medium consistency, moist)
	2.6 – 5.5 Sample No. 2 @ 3.5' Sample No. 3 @ 3.8'	Gray-brown, light gray, orange-brown fine SAND (slightly mottled), some silty clay, trace rounded gravel (medium dense, moist) Lab results for sample S-3 • Moisture: 18.6% • Percent passing No. 270 sieve: 24.6% • USDA: Sandy Loam • USCS: SM (cemented sands 3.7 to 4.2 feet b.e.g.s)
	5.5 – – – Sample No. 4 @ 6.5'	Light brown fine to medium SAND, trace to little silty clay (loose density, wet)

NOTES:

1) Test pit excavated by Feldmann Brothers' personnel utilizing a rubber tired backhoe.
2) Ground surface elevations provided on a drawing titled "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," prepared by the Becker Morgan Group, dated October 21, 2010.
3) Test pit terminated approximately 7.0 feet below the existing ground surface (b.e.g.s.).
4) Rapid groundwater seepage was observed in the test pit at a depth of 5.5 ft b.e.g.s. during excavation.
5) Moderate sidewall caving of excavation side walls observed from approximately 5.0 to 7.0 feet b.e.g.s. during excavation.
6) Water level at 5.6 feet b.e.g.s., bottom of excavation at 6.0 ft. b.e.g.s. at completion of excavation.
7) Seasonal high water table estimated to be approximately 3 ft b.e.g.s. based on observed redoximorphic features.
8) Single ring infiltration test performed at approximately 3.5 feet b.e.g.s.
9) Test pit backfilled with excavated soils upon completion.
10) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 9, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
I-4	0 – 0.8	TOPSOIL
(Elev. 49.7 feet)	0.8 – 3.2 Sample No. 1 @ 2.0'	Light brown clayey SILT, little fine sand, trace rounded gravel (medium consistency, moist)
	3.2– 3.8	Orange-brown, red-brown fine SAND, little silty clay, trace rounded gravel (dense, moist)
	3.8 – 4.5	Gray, orange-brown SILT (mottled), little fine sand, trace clay (stiff consistency, moist)
	4.5 – – – Sample No. 2 @ 4.5' Sample No. 3 @ 5'	Light orange-brown fine SAND, some silty clay (medium dense, moist) Lab results for sample S-3 • Moisture: 18.1% • Percent passing No. 270 sieve: 19.7% • USDA: Sandy Loam • USCS: SM

NOTES:

1. Test pit excavated by Feldmann Brothers' personnel utilizing a rubber tired backhoe.
2. Ground surface elevations provided on a drawing titled "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," prepared by the Becker Morgan Group, dated October 21, 2010.
3. Test pit terminated approximately 9.0 feet below the existing ground surface (b.e.g.s.).
4. Moderate groundwater seepage was observed in the test pit at a depth of 8.0 ft b.e.g.s. during excavation.
5. Moderate sidewall caving of excavation side walls observed from approximately 7.0 to 9.0 feet b.e.g.s. during excavation.
6. Water level at 8.5 feet b.e.g.s., bottom of excavation at 8.8 ft. b.e.g.s. at completion of excavation.
7. Seasonal high water table estimated to be approximately 5.8 ft b.e.g.s. based on observed redoximorphic features.
8. Single ring infiltration test performed at approximately 4.5 feet b.e.g.s.
9. Test pit backfilled with excavated soils upon completion.
10. Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 9, 2010

LOGGED BY: TRA

Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
I-5	0 – 0.8	TOPSOIL
(Elev. 52.8 feet)	0.8 – 2.1 Sample No. 1 @ 1.5'	Orange, light brown, dark brown silty CLAY, trace fine sand (stiff consistency, moist)
	2.1 – 3.2 Sample No. 2 @ 2.5	Brown, light brown fine SAND and silty CLAY, trace medium sand (medium dense, moist)
	3.2 – – – Sample No. 3 @ 3.8' Sample No. 4 @ 4.0'	Light brown, light gray fine to medium SAND, some silty clay, trace rounded gravel (medium dense, moist) Lab results for sample S-4 • Moisture: 15.2% • Percent passing No. 270 sieve: 20.4% • USDA: Sandy Loam • USCS: SM
	Sample No. 5 @ 6.5'	Light brown, light gray fine to medium SAND, little silty clay, trace rounded gravel (medium dense, wet)

NOTES:
(1) Test pit excavated by Feldmann Brothers' personnel utilizing a rubber tired backhoe.
(2) Ground surface elevations provided on a drawing titled "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," prepared by the Becker Morgan Group, dated October 21, 2010.
(3) Test pit terminated approximately 7.5 feet below the existing ground surface (b.e.g.s.).
(4) No groundwater seepage or sidewall caving observed during the excavation of the test pit.
(5) No apparent redoximorphic features indicating seasonal high water table observed.
(6) Single ring infiltration test performed at approximately 4 feet b.e.g.s.
(7) Test pit backfilled with excavated soils upon completion.
(8) Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

DUFFIELD ASSOCIATES
Consultants in the Geosciences

TEST PIT
DESCRIPTIVE LOG

PROJECT: Dover High School | PROJECT NO.: 7158.GC

CLIENT: Becker Morgan Group | DATE: November 9, 2010

LOGGED BY: TRA

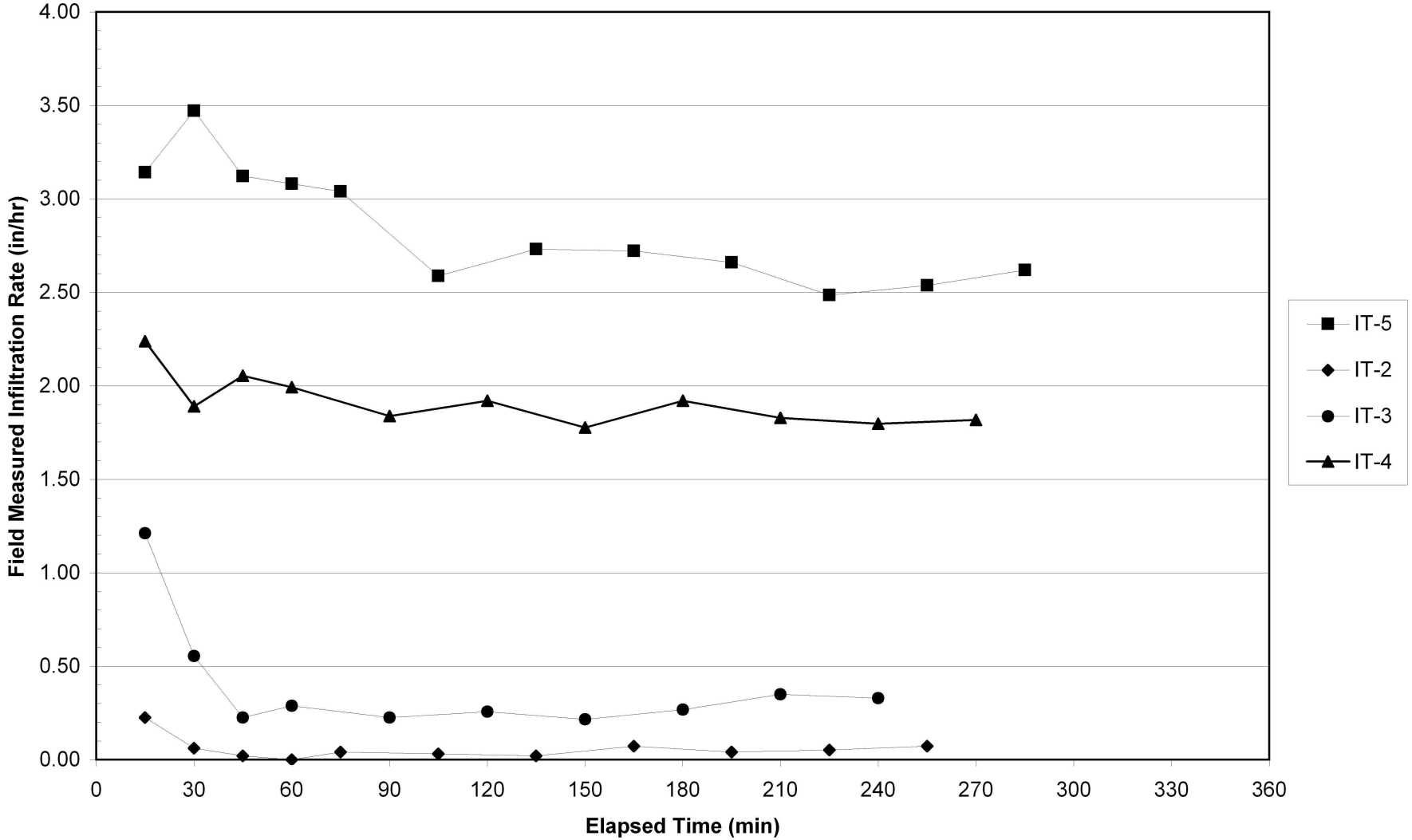
Test Pit No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
I-6	0 – 0.7	TOPSOIL
(Elev. 49.7 feet)	0.7 – 2.3 Sample No. 1 @ 1.5'	Light gray-brown silty CLAY, little fine sand (medium consistency, moist)
	2.3 – 6.0 Sample No. 2 @ 4.0'	Light gray-brown, orange-brown fine SAND (slightly mottled) some to and silty CLAY, trace medium sand (medium dense, moist)
	6.0 – – – Sample No. 3 @ 8.0'	Orange-brown, light gray fine SAND (slightly mottled), little silty clay, trace medium sand (medium dense, wet)

NOTES:

1. Test pit excavated by Feldmann Brothers' personnel utilizing a rubber tired backhoe.
2. Ground surface elevations provided on a drawing titled "Dover High School Capital School District, Boring Locations – As Staked 2010-10-29," prepared by the Becker Morgan Group, dated October 21, 2010.
3. Test pit terminated approximately 11.0 feet below the existing ground surface (b.e.g.s.).
4. Slight groundwater seepage was observed in the test pit at a depth of 9.0 ft b.e.g.s.
5. Slight sidewall caving of excavation side walls observed from approximately 7.0 to 9.0 feet b.e.g.s., 0.5 hours after completion of excavation.
6. Water level at 8.5 feet b.e.g.s., bottom of excavation at 9.0 ft. b.e.g.s. 1.0 hour after completion of excavation.
7. Seasonal high water table estimated to be approximately 2.5 ft b.e.g.s. based on observed redoximorphic features.
8. Test pit backfilled with excavated soils upon completion.
9. Soil descriptions and classifications were performed in general accordance with ASTM D:2488 (Visual-Manual Procedure) and ASTM D:2487 (Unified Soil Classification System) along with laboratory analysis if analysis was performed.

Proposed Dover High School
Capital School District

Infiltration Test Results Plot



DUFFIELD ASSOCIATES
Consultants in the Geosciences

Dover High School
Project No: 7158.GC
November 2010

APPENDIX C

GENERAL NOTES

GENERAL NOTES

DUFFIELD ASSOCIATES uses the following definitions and terminology to classify and correlate the field and laboratory samples.

VISUAL UNIFIED CLASSIFICATIONS: The soil samples are described by color, major constituent, modifiers (by percentage), and density (or consistency). Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a No. 200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a No. 200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are noncohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

The Unified Soil Classification symbols are:

COARSE GRAINED SOILS

GW - Well graded gravels
GP - Poorly graded gravels
GM - Silty gravels
GC - Clayey gravels
SW - Well graded sands
SP - Poorly graded sands
SM - Silty sands
SC - Clayey sands

FINE GRAINED SOILS

ML - Silts of low plasticity
CL - Clays of low to medium plasticity
OL - Organic silt clays of low plasticity
MH - Silts of high plasticity
CH - Clays of high plasticity
OH - Organic silt clays of high plasticity
PT - Peat and highly organic soils

SIZE DESCRIPTION

F - Fine
M - Medium
C - Coarse
G - Gravel

MODIFIERS (PERCENTAGE)

Tr -	Trace	1 - 10%
Ltl -	Little	11 - 20%
Some		21 - 35%
& -	And	36 - 50%

COLOR

Or - Orange
Yel - Yellow
Br - Brown
Blk - Black
Gr - Gray
R - Red
Vc - Varicolored
Dk - Dark
Lt - Light

DENSITY: COARSE GRAINED SOILS

Very loose	4 blows/ft or less
Loose	5 to 10 blows/ft
Medium	11 to 30 blows/ft
Dense	31 to 50 blows/ft
Very Dense	51 blows/ft or more

CONSISTENCY: FINE GRAINED SOILS

Very soft	2 blows/ft or less
Soft	3 to 4 blows/ft
Medium	5 to 8 blows/ft
Stiff	9 to 15 blows/ft
Very stiff	16 to 30 blows/ft
Hard	31 blows/ft or more

NOTE: The Standard Penetration Test "N" value is the number of blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

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Contract NDHS-33: Site, Field, Stadiums and Accessories

BID FORM

For Bids Due: _____ To: Capital School District
945 Forest Street
Dover, Delaware 19904

Name of Bidder: _____

Bidder Address: _____

_____

Contact Name: _____ E-Mail Address: _____

Delaware Business License No.:_____ Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ Fax No.: ( ) _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____ ($_____)

ALTERNATES

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-29: Add (4) Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add/Deduct _____($_____)

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add/Deduct _____($_____)

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add/Deduct _____($_____)

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add/Deduct _____($_____)

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add/Deduct _____($_____)

UNIT PRICES

N/A

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for one hundred twenty (120) days (Project Manager's Note: Verify and coordinate with Section 00 21 13 Instruction to Bidders.) from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address:_____
_____
_____
_____

Witness: _____ By: _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Bid Bond
Consent of Surety
(Others as Required by Project Manuals)

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Owner, it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.

Subcontractor Category	Subcontractor	Address (City & State)
1. Sitework		
2. Landscaping		
3.		
4.		
5.		

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date _____.

All the terms and conditions of Contract NDHS-33 Site, Field, Stadiums and Accessories has been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20_____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____of _____in the County of _____ and State of _____ as Principal, and _____of _____in the County of _____ _____ and State of _____ as Surety, legally authorized to do business in the State of Delaware ('State"), are held and firmly unto the Capital School District in the sum of _____ Dollars (S_____), or percent not to exceed _____ Dollars (S_____) of amount of bid on Contract No. _____ to be paid to the Capital School District for the use and benefit of the Capital School District for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators. and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden Principal who has submitted to the Capital School District a certain proposal to enter into this contract for the furnishing of certain material and/or services within the State, shall be awarded this Contract, and if said Principal shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the Capital School District this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____seal and dated this____day of _____in the year of our Lord two thousand and _____(20__).

SEALED, AND DELIVERED IN THE PRESENCE OF

_____
Name of Bidder (Organization)

Corporate Seal

By:_____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness_____

_____

_____
Title

CONSENT OF SURETY

DATE_____

To: Capital School District
945 Forest Street
Dover, Delaware 19904

Gentlemen:

We, the _____

_____
(Surety Company's Address)

_____

a Surety Company authorized to do business in the State of Delaware hereby agrees that if

_____
(Contractor)

_____
(Address)

_____

is awarded the Contract No. _____

We will write the required Performance and/or Labor and Material Bond required by Paragraph 8 of the Instructions to Bidders.

_____
(Surety Company)

By _____
(Attorney-in-Fact)

END OF SECTION

Contract NDHS-34: General Construction

BID FORM

For Bids Due: _____ To: Capital School District
945 Forest Street
Dover, Delaware 19904

Name of Bidder: _____

Bidder Address: _____

_____

Contact Name: _____ E-Mail Address: _____

Delaware Business License No.:_____ Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ Fax No.: ( ) _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____ ($_____)

ALTERNATES

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-29: Add (4) Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add/Deduct _____($_____)

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add/Deduct _____($_____)

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add/Deduct _____($_____)

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add/Deduct _____($_____)

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add/Deduct _____($_____)

UNIT PRICES

N/A

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for one hundred twenty (120) days (Project Manager's Note: Verify and coordinate with Section 00 21 13 Instruction to Bidders.) from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address:_____
_____
_____
_____

Witness: _____ By: _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Bid Bond
Consent of Surety
(Others as Required by Project Manuals)

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Owner, it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.

Subcontractor Category	Subcontractor	Address (City & State)
1. General Construction		
2. Masonry		
3. Electrical		
4. Mechanical		
5.		

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date _____.

All the terms and conditions of Contract NDHS-34 General Construction has been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20_____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____of _____in the County of _____ and State of _____ as Principal, and _____of _____in the County of _____ _____ and State of _____ as Surety, legally authorized to do business in the State of Delaware ('State"), are held and firmly unto the Capital School District in the sum of _____ Dollars (S_____), or percent not to exceed _____ Dollars (S_____) of amount of bid on Contract No. _____ to be paid to the Capital School District for the use and benefit of the Capital School District for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators. and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden Principal who has submitted to the Capital School District a certain proposal to enter into this contract for the furnishing of certain material and/or services within the State, shall be awarded this Contract, and if said Principal shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the Capital School District this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____seal and dated this____day of _____in the year of our Lord two thousand and _____(20__).

SEALED, AND DELIVERED IN THE PRESENCE OF

_____
Name of Bidder (Organization)

Corporate Seal

By:_____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness_____

_____

_____
Title

CONSENT OF SURETY

DATE_____

To: Capital School District
945 Forest Street
Dover, Delaware 19904

Gentlemen:

We, the _____

_____
(Surety Company's Address)

_____

a Surety Company authorized to do business in the State of Delaware hereby agrees that if

_____
(Contractor)

_____
(Address)

_____

is awarded the Contract No. _____

We will write the required Performance and/or Labor and Material Bond required by Paragraph 8 of the Instructions to Bidders.

_____
(Surety Company)

By _____
(Attorney-in-Fact)

END OF SECTION

Contract NDHS-35: Turf Field & Track

BID FORM

For Bids Due: _____ To: Capital School District
945 Forest Street
Dover, Delaware 19904

Name of Bidder: _____

Bidder Address: _____

_____

Contact Name: _____ E-Mail Address: _____

Delaware Business License No.:_____ Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ Fax No.: ( ) _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____ ($_____)

ALTERNATES

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-29: Add (4) Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add/Deduct _____($_____)

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add/Deduct _____($_____)

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add/Deduct _____($_____)

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add/Deduct _____($_____)

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add/Deduct _____($_____)

UNIT PRICES

N/A

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for one hundred twenty (120) days (Project Manager's Note: Verify and coordinate with Section 00 21 13 Instruction to Bidders.) from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address:_____
_____
_____
_____

Witness: _____ By: _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Bid Bond
Consent of Surety
(Others as Required by Project Manuals)

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Owner, it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.

Subcontractor Category	Subcontractor	Address (City & State)
1. Synthetic Turf		
2. Track Scape		
3.		
4.		
5.		

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date _____.

All the terms and conditions of Contract NDHS-35 Turf Field & Track has been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____of _____in the County of _____ and State of _____ as Principal, and _____of _____in the County of _____ _____ and State of _____ as Surety, legally authorized to do business in the State of Delaware ('State"), are held and firmly unto the Capital School District in the sum of _____ Dollars (S_____), or percent not to exceed _____ Dollars (S_____) of amount of bid on Contract No. _____ to be paid to the Capital School District for the use and benefit of the Capital School District for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators. and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden Principal who has submitted to the Capital School District a certain proposal to enter into this contract for the furnishing of certain material and/or services within the State, shall be awarded this Contract, and if said Principal shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the Capital School District this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____seal and dated this____day of _____in the year of our Lord two thousand and _____(20__).

SEALED, AND DELIVERED IN THE PRESENCE OF

_____
Name of Bidder (Organization)

Corporate Seal

By:_____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness_____

_____

_____
Title

CONSENT OF SURETY

DATE_____

To: Capital School District
945 Forest Street
Dover, Delaware 19904

Gentlemen:

We, the _____

_____
(Surety Company's Address)

_____

a Surety Company authorized to do business in the State of Delaware hereby agrees that if

_____
(Contractor)

_____
(Address)

_____

is awarded the Contract No. _____

We will write the required Performance and/or Labor and Material Bond required by Paragraph 8 of the Instructions to Bidders.

_____
(Surety Company)

By _____
(Attorney-in-Fact)

END OF SECTION

Contract NDHS-36: Fencing, Gates & Backstops

BID FORM

For Bids Due: _____ To: Capital School District
945 Forest Street
Dover, Delaware 19904

Name of Bidder: _____

Bidder Address: _____

_____

Contact Name: _____ E-Mail Address: _____

Delaware Business License No.:_____ Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ Fax No.: ( ) _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____ ($_____)

ALTERNATES

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-29: Add (4) Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add/Deduct _____($_____)

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add/Deduct _____($_____)

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add/Deduct _____($_____)

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add/Deduct _____($_____)

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add/Deduct _____($_____)

UNIT PRICES

N/A

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for one hundred twenty (120) days (Project Manager's Note: Verify and coordinate with Section 00 21 13 Instruction to Bidders.) from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address:_____
_____
_____
_____

Witness: _____ By: _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Bid Bond
Consent of Surety
(Others as Required by Project Manuals)

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Owner, it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.

Subcontractor Category	Subcontractor	Address (City & State)
1. Fencing		
2.		
3.		
4.		
5.		

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date _____.

All the terms and conditions of Contract NDHS-36 Fencing, Gates & Backstops has been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20_____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____of _____in the County of _____ and State of _____ as Principal, and _____of _____in the County of _____ _____ and State of _____ as Surety, legally authorized to do business in the State of Delaware ('State"), are held and firmly unto the Capital School District in the sum of _____ Dollars (S_____), or percent not to exceed _____ Dollars (S_____) of amount of bid on Contract No. _____ to be paid to the Capital School District for the use and benefit of the Capital School District for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators. and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden Principal who has submitted to the Capital School District a certain proposal to enter into this contract for the furnishing of certain material and/or services within the State, shall be awarded this Contract, and if said Principal shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the Capital School District this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____seal and dated this____day of _____in the year of our Lord two thousand and _____(20__).

SEALED, AND DELIVERED IN THE PRESENCE OF

_____
Name of Bidder (Organization)

Corporate Seal

By:_____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness_____

_____

_____
Title

CONSENT OF SURETY

DATE_____

To: Capital School District
945 Forest Street
Dover, Delaware 19904

Gentlemen:

We, the _____

_____
(Surety Company's Address)

_____

a Surety Company authorized to do business in the State of Delaware hereby agrees that if

_____
(Contractor)

_____
(Address)

_____

is awarded the Contract No. _____

We will write the required Performance and/or Labor and Material Bond required by Paragraph 8 of the Instructions to Bidders.

_____
(Surety Company)

By _____
(Attorney-in-Fact)

END OF SECTION

Contract NDHS-37: Site Concrete

BID FORM

For Bids Due: _____ To: Capital School District
945 Forest Street
Dover, Delaware 19904

Name of Bidder: _____

Bidder Address: _____

_____

Contact Name: _____ E-Mail Address: _____

Delaware Business License No.:_____ Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ Fax No.: ( ) _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____ ($_____)

ALTERNATES

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-29: Add (4) Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add/Deduct _____($_____)

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add/Deduct _____($_____)

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add/Deduct _____($_____)

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add/Deduct _____($_____)

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add/Deduct _____($_____)

UNIT PRICES

N/A

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for one hundred twenty (120) days (Project Manager's Note: Verify and coordinate with Section 00 21 13 Instruction to Bidders.) from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address:_____
_____
_____
_____

Witness: _____ By: _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Bid Bond
Consent of Surety
(Others as Required by Project Manuals)

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Owner, it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.

Subcontractor Category	Subcontractor	Address (City & State)
1. Concrete		
2.		
3.		
4.		
5.		

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date _____.

All the terms and conditions of Contract NDHS-37 Site Concrete has been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____of _____in the County of _____ and State of _____ as Principal, and _____of _____in the County of _____ _____ and State of _____ as Surety, legally authorized to do business in the State of Delaware ('State"), are held and firmly unto the Capital School District in the sum of _____ Dollars (S_____), or percent not to exceed _____ Dollars (S_____) of amount of bid on Contract No. _____ to be paid to the Capital School District for the use and benefit of the Capital School District for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators. and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden Principal who has submitted to the Capital School District a certain proposal to enter into this contract for the furnishing of certain material and/or services within the State, shall be awarded this Contract, and if said Principal shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the Capital School District this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____seal and dated this____day of _____in the year of our Lord two thousand and _____(20__).

SEALED, AND DELIVERED IN THE PRESENCE OF

_____
Name of Bidder (Organization)

Corporate Seal

By:_____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness_____

_____

_____
Title

CONSENT OF SURETY

DATE_____

To: Capital School District
945 Forest Street
Dover, Delaware 19904

Gentlemen:

We, the _____

_____
(Surety Company's Address)

_____

a Surety Company authorized to do business in the State of Delaware hereby agrees that if

_____
(Contractor)

_____
(Address)

_____

is awarded the Contract No. _____

We will write the required Performance and/or Labor and Material Bond required by Paragraph 8 of the Instructions to Bidders.

_____
(Surety Company)

By _____
(Attorney-in-Fact)

END OF SECTION

Contract NDHS-38: Bleachers & Grandstands

BID FORM

For Bids Due: _____ To: Capital School District
945 Forest Street
Dover, Delaware 19904

Name of Bidder: _____

Bidder Address: _____

_____

Contact Name: _____ E-Mail Address: _____

Delaware Business License No.:_____ Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ Fax No.: ( ) _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____ ($_____)

ALTERNATES

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-29: Add (4) Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add/Deduct _____($_____)

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add/Deduct _____($_____)

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add/Deduct _____($_____)

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add/Deduct _____($_____)

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add/Deduct _____($_____)

UNIT PRICES

N/A

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for one hundred twenty (120) days (Project Manager's Note: Verify and coordinate with Section 00 21 13 Instruction to Bidders.) from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address:_____
_____
_____
_____

Witness: _____ By: _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Bid Bond
Consent of Surety
(Others as Required by Project Manuals)

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Owner, it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.

Subcontractor Category	Subcontractor	Address (City & State)
1. Bleacher/Grandstand Installation		
2.		
3.		
4.		
5.		

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date _____.

All the terms and conditions of Contract NDHS-38 Bleachers & Grandstands has been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20_____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____of _____in the County of _____ and State of _____ as Principal, and _____of _____in the County of _____ _____ and State of _____ as Surety, legally authorized to do business in the State of Delaware ('State"), are held and firmly unto the Capital School District in the sum of _____ Dollars (S_____), or percent not to exceed _____ Dollars (S_____) of amount of bid on Contract No. _____ to be paid to the Capital School District for the use and benefit of the Capital School District for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators. and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden Principal who has submitted to the Capital School District a certain proposal to enter into this contract for the furnishing of certain material and/or services within the State, shall be awarded this Contract, and if said Principal shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the Capital School District this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____seal and dated this____day of _____in the year of our Lord two thousand and _____(20__).

SEALED, AND DELIVERED IN THE PRESENCE OF

_____
Name of Bidder (Organization)

Corporate Seal

By:_____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness_____

_____

_____
Title

CONSENT OF SURETY

DATE_____

To: Capital School District
945 Forest Street
Dover, Delaware 19904

Gentlemen:

We, the _____

_____
(Surety Company's Address)

_____

a Surety Company authorized to do business in the State of Delaware hereby agrees that if

_____
(Contractor)

_____
(Address)

_____

is awarded the Contract No. _____

We will write the required Performance and/or Labor and Material Bond required by Paragraph 8 of the Instructions to Bidders.

_____
(Surety Company)

By _____
(Attorney-in-Fact)

END OF SECTION

Contract NDHS-39: Site Electrical

BID FORM

For Bids Due: _____ To: Capital School District
945 Forest Street
Dover, Delaware 19904

Name of Bidder: _____

Bidder Address: _____

_____

Contact Name: _____ E-Mail Address: _____

Delaware Business License No.:_____ Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ Fax No.: ( ) _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____ ($_____)

ALTERNATES

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-29: Add (4) Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add/Deduct _____($_____)

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add/Deduct _____($_____)

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add/Deduct _____($_____)

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add/Deduct _____($_____)

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add/Deduct _____($_____)

UNIT PRICES

N/A

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for one hundred twenty (120) days (Project Manager's Note: Verify and coordinate with Section 00 21 13 Instruction to Bidders.) from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address:_____
_____
_____
_____

Witness: _____ By: _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Bid Bond
Consent of Surety
(Others as Required by Project Manuals)

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Owner, it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.

Subcontractor Category	Subcontractor	Address (City & State)
1. Electrical		
2.		
3.		
4.		
5.		

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date _____.

All the terms and conditions of Contract NDHS-39 Site Electrical has been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____of _____in the County of _____ and State of _____ as Principal, and _____of _____in the County of _____ _____ and State of _____ as Surety, legally authorized to do business in the State of Delaware ('State"), are held and firmly unto the Capital School District in the sum of _____ Dollars (S_____), or percent not to exceed _____ Dollars (S_____) of amount of bid on Contract No. _____ to be paid to the Capital School District for the use and benefit of the Capital School District for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators. and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden Principal who has submitted to the Capital School District a certain proposal to enter into this contract for the furnishing of certain material and/or services within the State, shall be awarded this Contract, and if said Principal shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the Capital School District this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____seal and dated this____day of _____in the year of our Lord two thousand and _____(20__).

SEALED, AND DELIVERED IN THE PRESENCE OF

_____
Name of Bidder (Organization)

Corporate Seal

By:_____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness_____

_____

_____
Title

CONSENT OF SURETY

DATE_____

To: Capital School District
945 Forest Street
Dover, Delaware 19904

Gentlemen:

We, the _____

_____
(Surety Company's Address)

_____

a Surety Company authorized to do business in the State of Delaware hereby agrees that if

_____
(Contractor)

_____
(Address)

_____

is awarded the Contract No. _____

We will write the required Performance and/or Labor and Material Bond required by Paragraph 8 of the Instructions to Bidders.

_____
(Surety Company)

By _____
(Attorney-in-Fact)

END OF SECTION

Contract NDHS-40: Outdoor Scoreboards

BID FORM

For Bids Due: _____ To: Capital School District
945 Forest Street
Dover, Delaware 19904

Name of Bidder: _____

Bidder Address: _____

_____

Contact Name: _____ E-Mail Address: _____

Delaware Business License No.:_____ Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ Fax No.: ( ) _____ - _____

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____ ($_____)

ALTERNATES

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-29: Add (4) Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add/Deduct _____($_____)

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add/Deduct _____($_____)

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add/Deduct _____($_____)

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add/Deduct _____($_____)

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add/Deduct _____($_____)

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add/Deduct _____($_____)

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add/Deduct _____($_____)

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add/Deduct _____($_____)

UNIT PRICES

N/A

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for one hundred twenty (120) days (Project Manager's Note: Verify and coordinate with Section 00 21 13 Instruction to Bidders.) from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address:_____
_____
_____
_____

Witness: _____ By: _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Bid Bond
Consent of Surety
(Others as Required by Project Manuals)

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Owner, it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.

Subcontractor Category	Subcontractor	Address (City & State)
1. Scoreboard Installer		
2.		
3.		
4.		
5.		

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date _____.

All the terms and conditions of Contract NDHS-40 Outdoor Scoreboards has been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20_____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____of _____in the County of _____ and State of _____ as Principal, and _____of _____in the County of _____ _____ and State of _____ as Surety, legally authorized to do business in the State of Delaware ('State"), are held and firmly unto the Capital School District in the sum of _____ Dollars (S_____), or percent not to exceed _____ Dollars (S_____) of amount of bid on Contract No. _____ to be paid to the Capital School District for the use and benefit of the Capital School District for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators. and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden Principal who has submitted to the Capital School District a certain proposal to enter into this contract for the furnishing of certain material and/or services within the State, shall be awarded this Contract, and if said Principal shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the Capital School District this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____seal and dated this____day of _____in the year of our Lord two thousand and _____(20__).

SEALED, AND DELIVERED IN THE PRESENCE OF

_____
Name of Bidder (Organization)

Corporate Seal

By:_____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness_____

_____

_____
Title

CONSENT OF SURETY

DATE_____

To: Capital School District
945 Forest Street
Dover, Delaware 19904

Gentlemen:

We, the _____

_____
(Surety Company's Address)

_____

a Surety Company authorized to do business in the State of Delaware hereby agrees that if

_____
(Contractor)

_____
(Address)

_____

is awarded the Contract No. _____

We will write the required Performance and/or Labor and Material Bond required by Paragraph 8 of the Instructions to Bidders.

_____
(Surety Company)

By _____
(Attorney-in-Fact)

END OF SECTION

SECTION 00 52 00 - AGREEMENT

1. SUMMARY

1.1. The Agreement Form for this Project is either the American Institute of Architects Standard Form of Agreement between Owner and Contractor where the basis of payment is a Stipulated Sum 1992 Construction Manager – Advisor Edition AIA Document A101/CMa 1992 Edition.

1.2 A copy of A101/CMa – 1992 Edition is bound into this Project Manual following this page.

1.2.1 Under Article 5.8 add the following:

"Upon completion of the work under the Contract, the Owner may release 60% of the amount then retained. The balance of the amount retained will be held until:

A. All reports required of the Contract are received;
B. All Subcontractors in trades listed on the Bid Form are paid by the Contractor, unless the amount owed to the Subcontractor is disputed, in which case the Owner may withhold 150% of the amount withheld by the Contractor in its dispute with the Subcontractor; and
C. Final payment is authorized by the Owner."

END OF SECTION

AIA Document A101/CMa

Standard Form of Agreement Between Owner and Contractor

where the basis of payment is a STIPULATED SUM

1992 CONSTRUCTION MANAGER-ADVISER EDITION

THIS DOCUMENT HAS IMPORTANT LEGAL CONSEQUENCES; CONSULTATION WITH AN ATTORNEY IS ENCOURAGED WITH RESPECT TO ITS COMPLETION OR MODIFICATION.

The 1992 Edition of AIA Document A201/CMa, General Conditions of the Contract for Construction, Construction Manager-Adviser Edition, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

AGREEMENT

made as of the day of in the year of
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name and address)
Capital School District
945 Forest Street
Dover, Delaware 19904
and the Contractor:
(Name and address)

For the following Project:
(Include detailed description of Project, location, address and scope.)
New Dover High School

The Construction Manager is:
(Name and address)
EDiS Company
110 South Poplar Street, Suite 400
Wilmington, Delaware 19801

The Architect is:
(Name and address)
ABHA
1621 N. Lincoln Street
Wilmington, Delaware 19806

The Owner and Contractor agree as set forth below.

Copyright 1975, 1980, ©1992 by The American Institute of Architects, 1735 New York Avenue, N.W., Washington, D.C. 20006-5292. Reproduction of the material herein or substantial quotation of its provisions without the written permission of the AIA violates the copyright laws of the United States and will subject the violator to legal prosecution.

ARTICLE 1
THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement; these form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

ARTICLE 2
THE WORK OF THIS CONTRACT

The Contractor shall execute the entire Work described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others, or as follows:

ARTICLE 3
DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3.1 The date of commencement is the date from which the Contract Time of Paragraph 3.2 is measured, and shall be the date of this Agreement, as first written above, unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

(Insert the date of commencement, if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

Unless the date of commencement is established by a notice to proceed issued by the Owner, the Contractor shall notify the Owner, through the Construction Manager, in writing not less than five days before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

3.2 The Contractor shall achieve Substantial Completion of the entire Work not later than

(Insert the calendar date or number of calendar days after the date of commencement. Also insert any requirements for earlier Substantial Completion of certain portions of the Work, if not stated elsewhere in the Contract Documents.)

Per contract documents.

, subject to adjustments of this Contract Time as provided in the Contract Documents.

(Insert provisions, if any, for liquidated damages relating to failure to complete on time.)

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ARTICLE 4
CONTRACT SUM

4.1 The Owner shall pay the Contractor in current funds for the Contractor's performance of the Contract the Contract Sum of Dollars ($), subject to additions and deductions as provided in the Contract Documents.

4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If decisions on other alternates are to be made by the Owner subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date until which that amount is valid.)

4.3 Unit prices, if any, are as follows:

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ARTICLE 5
PROGRESS PAYMENTS

5.1 Based upon Applications for Payment submitted by the Contractor to the Construction Manager, and upon Project Applications and Certificates for Payment issued by the Construction Manager and Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

5.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

5.3 Provided an Application for Payment is submitted to the Construction Manager not later than the 25th day of a month, the Owner shall make payment to the Contractor not later than the 7th day of the month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment shall be made by the Owner not later than thirty (30) days after the Construction Manager receives the Application for Payment.

5.4 Each Application for Payment shall be based upon the Schedule of Values submitted by the Contractor in accordance with the Contract Documents. The Schedule of Values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager or Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

5.5 Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

5.6 Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

5.6.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the Work in the Schedule of Values, less retainage of five percent (5 %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Subparagraph 7.3.7 of the General Conditions;

5.6.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of five percent (5 %);

5.6.3 Subtract the aggregate of previous payments made by the Owner; and

5.6.4 Subtract amounts, if any, for which the Construction Manager or Architect has withheld or nullified a Certificate for Payment as provided in Paragraph 9.5 of the General Conditions.

5.7 The progress payment amount determined in accordance with Paragraph 5.6 shall be further modified under the following circumstances:

5.7.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to one hundred percent (100 %) of the Contract Sum, less such amounts as the Construction Manager recommends and the Architect determines for incomplete Work and unsettled claims; and

5.7.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Subparagraph 9.10.3 of the General Conditions.

5.8 Reduction or limitation of retainage, if any, shall be as follows:

(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Subparagraphs 5.6.1 and 5.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

In addition to retainage, 3.5% will be withheld for closeout documents.
This shall appear as a line item on the application for payment.

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ARTICLE 6
FINAL PAYMENT

Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when (1) the Contract has been fully performed by the Contractor except for the Contractor's responsibility to correct nonconforming Work as provided in Subparagraph 12.2.2 of the General Conditions and to satisfy other requirements, if any, which necessarily survive final payment; and (2) a final Project Certificate for Payment has been issued by the Construction Manager and Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the final Project Certificate for Payment, or as follows:

ARTICLE 7
MISCELLANEOUS PROVISIONS

7.1 Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

7.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

(Usury laws and requirements under the Federal Truth in Lending Act, similar state and local consumer credit laws and other regulations at the Owner's and Contractor's principal places of business, the location of the Project and elsewhere may affect the validity of this provision. Legal advice should be obtained with respect to deletions or modifications, and also regarding requirements such as written disclosures or waivers.)

7.3 Temporary facilities and services:

(Here insert temporary facilities and services which are different from or in addition to those included elsewhere in the Contract Documents.)

7.4 Other Provisions:

(Here list any special provisions affecting the Contract.)

ARTICLE 8
TERMINATION OR SUSPENSION

8.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of the General Conditions.

8.2 The Work may be suspended by the Owner as provided in Article 14 of the General Conditions.

ARTICLE 9
ENUMERATION OF CONTRACT DOCUMENTS

9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:

9.1.1 The Agreement is this executed Standard Form of Agreement Between Owner and Contractor, AIA Document A101/CMa, 1992 Construction Manager-Adviser Edition.

9.1.2 The General Conditions are the General Conditions of the Contract for Construction, AIA Document A201/CMa, 1992 Construction Manager-Adviser Edition.

9.1.3 The Supplementary and other Conditions of the Contract are those contained in the Project Manual dated , and are as follows:

Document	Title	Pages
Specification Section 00 73 00	Supplementary Conditions	17

9.1.4 The Specifications are those contained in the Project Manual dated as in Subparagraph 9.1.3, and are as follows:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Section	Title	Pages

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9.1.5 The Drawings are as follows, and are dated unless a different date is shown below:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

Number	Title	Date

9.1.6 The Addenda, if any, are as follows:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

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9.1.7 Other documents, if any, forming part of the Contract Documents are as follows:

(List here any additional documents which are intended to form part of the Contract Documents. The General Conditions provide that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

Contractor Proposal
Bid Bond
Letter of Intent
Certificate of Insurance
Performance and Payment Bonds

This Agreement is entered into as of the day and year first written above and is executed in at least four original copies of which one is to be delivered to the Contractor, one each to the Construction Manager and Architect for use in the administration of the Contract, and the remainder to the Owner.

OWNER	CONTRACTOR
(Signature)	*(Signature)*
(Printed name and title)	*(Printed name and title)*

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SECTION 00 61 13 – BONDS

1. PAYMENT AND PERFORMANCE BONDS

1.1 Bonds must be in the following form:

1. Form of Payment Bond AIA Document A312 - 2010 (attached).
2. Form of Performance Bond AIA Document A312 - 2010 (attached).

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____
Name and
Title:

SURETY
Company: *(Corporate Seal)*

Signature: _____
Name and
Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

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§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____
Name and
Title:

SURETY
Company: *(Corporate Seal)*

Signature: _____
Name and
Title:

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:
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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

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§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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(1666153014)

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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SECTION 00 62 16 – CERTIFICATE OF INSURANCE

In conjunction with Insurance Requirements AIA General Conditions, Article 11, the Contractor shall be bound by the following limits of liability insurance (for Contracts under this Bid Pac). The Contractor shall use the standard "ACCORD" for titled "Certificate of Insurance" in submitting his liability insurance limits. The required limits to be inserted in accordance with the sample "ACCORD" form in this section:

GENERAL NOTES

1. Other Insurance

   1.1 Contractor shall carry any necessary insurance required to cover Owned and Rental equipment that may be necessary for them to use in the performance of the Work.

2. Contractor shall have the following additional items added to his required "ACCORD" form Certificate of Insurance:

   1. Name and Address of Insured (Contractor).
   2. Description of Operations/Locations.

3. Added Insured – Capital School District and EDiS Company

4. Certificate Holder – Capital School District

Contractors shall note that although not a part of AIA Document A201/CMa – 1992 Edition or A201 – 1992 Edition, these additional articles apply as noted to this Project.

A sample certificate is bound into the Project Manual immediately following this Document.

END OF SECTION

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YY) XX/XX/XX

PRODUCER

PRODUCER INSURANCE AGENCY
PO BOX
PRODUCER STREET ADDRESS
PRODUCER CITY, ST PROD ZIP

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURERD

SAMPLE SUBCONTRACTOR CERTIFICATE
(REQUIRED MINIMUM INSURANCE)

INSURERS AFFORDING COVERAGE

INSURER A: XXXXXX
INSURED B XXXXXX
INSURER C: XXXXXX
INSURER D:
INSURER E:

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	DATE (MM/YY)	LIMITS	
	GENERAL LIABILITY	XXXXXXXXXXXXXXX	XXXXXXXX	XXXXXXXXXX	EACH OCCURRENCE	$ 1,000,000
	X COMMERCIAL GENERAL LIABILITY				FIRE DAMAGE (Any one fire)	$ 300,000
	CLAIMS MADE X OCCUR				MED EXP (Any one person)	$ 10,000
					PERSONAL & ADV INJURY	$ 1,000,000
					GENERAL AGGREGATE	$ 2,000,000
	GENL AGGREGATE LIMIT APPLIES PER:				PRODUCTS - COMP/OP AGG	$ 2,000,000
	POLICY X PRO-JECT LOC					
	AUTOMOBILE LIABILITY	XXXXXXXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	X ANY AUTO					
	ALL OWNED AUTOS				BODILY INJURY (Per person)	$
	SCHEDULED AUTOS					
	X HIREDAUTOS				BODILY INJURY (Per accident)	$
	X NON-OWNED AUTOS					
					PROPERTY DAMAGE (Per accident)	$
	GARAGE LIABILITY				AUTO ONLY - EA ACCIDENT	$
	ANY AUTO				OTHER THAN: AUTO ONLY: EA ACC	$
					AGG	$
	EXCESS LIABILITY	XXXXXXXXXXXXXXX	XXXXXXXXXXX	XXXXXXX	EACH OCCURRENCE	$ 5,000,000
	X OCCUR CLAIMS MADE				AGGREGATE	$ 5,000,000
						$
	DEDUCTIBLE					$
	RETENTION $					$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY	XXXXXXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXX	X WC STATUTORY LIMITS / OTHER	$
					E.L. EACH ACCIDENT	$ 500,000
					E.L. DISEASE - EA EMPLOYEE	$ 500,000
					E.L. DISEASE - POLICY LIMIT	$ 500,000
	OTHER					

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

Project: Capital School District, New Dover High School

Capital School District and EDiS Company shall be named as Additional Insured for both ongoing and completed operations. The endorsements providing the Additional Insured status for ongoing and completed operations must be attached to the Certificate of Insurance.

CERTIFICATE HOLDER X **ADDITIONAL INSURED; INSURER LETTER:** ——— **CANCELLATION**

EDiS Company
110 South Poplar Street
Suite 400
Wilmington, DE 19801

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30__ DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

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SECTION 00 72 00 – GENERAL CONDITIONS

1. SUMMARY

1.1. The General Conditions for this Project is the American Institute of Architects A201/CMa – 1992 Edition form for General Conditions of the Contract for Construction.

1.2 A copy of AIA General Conditions for this Project is bound into this Project Manual following this page.

END OF SECTION

AIA® Document A201/CMa™ – 1992

General Conditions of the Contract for Construction
where the Construction Manager is NOT a Constructor

for the following PROJECT:
(Name and location or address):
New Dover High School
Preliminary Site Improvements
Dover, Delaware 19904

THE OWNER:
(Name and address):
Capital School District
945 Forest Road
Dover, Delaware 19904

THE ARCHITECT:
(Name and address):
ABHA
1621 N. Lincoln Street
Wilmington, Delaware 19806

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 OWNER

3 CONTRACTOR

4 ADMINISTRATION OF THE CONTRACT

5 SUBCONTRACTORS

6 CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS

7 CHANGES IN THE WORK

8 TIME

9 PAYMENTS AND COMPLETION

10 PROTECTION OF PERSONS AND PROPERTY

11 INSURANCE AND BONDS

12 UNCOVERING AND CORRECTION OF WORK

13 MISCELLANEOUS PROVISIONS

14 TERMINATION OR SUSPENSION OF THE CONTRACT

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User Notes: (2752642138)

INDEX

Acceptance of Nonconforming Work 9.6.6, 9.9.3, **12.3**
Acceptance of Work 9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3
Access to Work **3.16**, 6.2.1, 12.1
Accident Prevention 4.6.6, 10
Acts and Omissions 3.2.1, 3.2.2, 3.3.2, 3.12.8, 3.18, 4.6.6, 4.6.2., 4.7.9, 8.3.1, 10.1.4, 10.2.5, 13.4.2, 13.7, 14.1
Addenda 1.1.1, 3.11
Additional Costs, Claims for 4.7.6, **4.7.7**, 4.7.9, 6.1.1, 10.3
Additional Inspections and Testing 4.6.10, 9.8.2, 12.2.1, 13.5
Additional Time, Claims for 4.7.6, **4.7.8**, 4.7.9, 8.3.2, 10.3
ADMINISTRATION OF THE CONTRACT 3.3.3, **4**, 9.4, 9.5
Advertisement or Invitation to Bid 1.1.1
Aesthetic Effect 4.6.20, 4.9.1
Allowances **3.8**
All-risk Insurance 11.3.1.1
Applications for Payment 4.6.9, 7.3.7, 9.2, **9.3**, 9.4, 9.5.1, 9.6.3, 9.8.3, 9.10.1, 9.10.3, 9.10.4, 11.1.3, 14.2.4
Approvals 2.4, 3.3.3, 3.5, 3.10.3, 3.12.4 through 3.12.8, 3.18.3, 4.6.12, 9.3.2, 11.3.1.4, 13.4.2, 13.5
Arbitration 4.5, 4.7.4, **4.9**, 8.3.1, 10.1.2, 11.3.9, 11.3.10
Architect **4.1**
Architect, and Certificate of Payment 4.6.9
Architect, Definition of 4.1.1
Architect, Extent of Authority 2.4.1, 3.12.6, 4.6.6, 4.7.2, 5.2, 6.3, 7.1.2, 7.2.1, 7.4, 9.2, 9.3.1, 9.4, 9.5, 9.6.3, 9.8.2, 9.8.3, 9.10.1, 9.10.3, 12.1, 12.2.1, 13.5.1, 13.5.2, 14.2.2, 14.2.4
Architect, Limitations of Authority and Responsibility 3.3.3, 3.12.8, 3.12.11, 4.6.5, 4.6.6, 4.6.10, 4.6.12, 4.6.17, 4.6.19, 4.6.20, 4.7.2, 5.2.1, 7.4, 9.6.4
Architect's Additional Services and Expenses 2.4, 9.8.2 11.3.1.1, 12.2.1, 12.2.4, 13.5.2, 13.5.3, 14.2.4
Architect's Administration of the Contract 4.6, 4.7.6, 4.7.7, 4.8, 9.4, 9.5
Architect's Approvals 2.4.1, 3.5.1, 3.10.3, 3.12.6, 3.12.8, 3.18.3, 4.6.12
Architect's Authority to Reject Work 3.5.1, 4.6.10, 12.1.2, 12.2.1
Architect's Copyright 1.3
Architect's Decisions 4.6.10, 4.6.12, 4.6.18, 4.6.19, 4.6.20. 4.7.2, 4.7.6, 4.8.1, 4.8.4, 4.9, 6.3, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.2, 9.9.1, 10.1.2,

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User Notes: (2752642138)

	13.5.2, 14.2.2, 14.2.4
Architect's Inspections	4.6.5, 4.6.16, 4.7.6, 9.4.3, 9.8.2, 9.9.2, 9.10.1, 13.5
Architect's Instructions	4.6.10, 4.6.12, 7.4.1, 9.4.3, 12.1, 13.5.2
Architect's Interpretations	4.6.18, 4.6.19, 4.7.7
Architect's On-Site Observations	4.6.5, 4.6.9, 4.7.6, 9.4.3, 9.5.1, 9.10.1, 13.5
Architect's Project Representative	4.6.17
Architect's Relationship with Contractor	1.1.2, 3.2.1, 3.2.2, 3.3.3, 3.5.1, 3.7.3, 3.11, 3.12.8, 3.12.11, 3.16, 3.18, 4.6.6, 4.6.7, 4.6.10, 4.6.12, 4.6.19, 5.2, 6.2.2, 7.3.4, 9.8.2, 10.1.2, 10.1.4, 10.1.5, 11.3.7, 12.1, 13.5
Architect's Relationship with Construction Manager	1.1.2, 2.4.1, 3.12.6, 3.12.8, 4.6.8, 4.6.10, 4.6.14, 4.6.16, 4.6.18, 6.3.1, 9.7.1, 9.8, 9.9.1, 9.9.2, 9.10.1, 9.10.2, 9.10.3, 12.2.4, 13.5.1, 13.5.2, 13.5.4, 14.2.4
Architect's Relationship with Subcontractors	1.1.2, 4.6.6, 4.6.7, 4.6.10, 5.3.1, 9.6.3, 9.6.4, 11.3.7
Architect's Representations	9.4.3, 9.5.1, 9.10.1
Architect's Site Visits	4.6.5, 4.6.9, 4.6.16, 4.7.6, 9.4.3, 9.5.1, 9.8.2, 9.9.2, 9.10.1, 13.5
Asbestos	10.1.2, 10.1.3, 10.1.4
Attorneys' Fees	3.18.1, 9.10.2, 10.1.4
Award of Separate Contracts	6.1.1
Award of Subcontracts and Other Contracts for Portions of the Work	**5.2**
Basic Definitions	**1.1**
Bidding Requirements	1.1.1, 1.1.7, 5.2.1, 11.4.1
Boiler and Machinery Insurance	**11.3.2**
Bonds, Lien	9.10.2
Bonds, Performance and Payment	7.3.6.4, 9.10.3, 11.3.9, 11.4
Building Permit	2.2.3, 3.7.1
Capitalization	**1.4**
Certificate of Substantial Completion	9.8.2
Certificates for Payment	4.6.8, 4.6.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7.1, 9.8.3, 9.10.1, 9.10.3, 13.7, 14.1.1.3, 14.2.4
Certificates of Inspection, Testing or Approval	3.12.11, 13.5.4
Certificates of Insurance	9.3.2, 9.10.2, 11.1.3
Change Orders	1.1.1, 2.4.1, 3.8.2.4, 3.11.1, 4.6.13, 4.7.3, 5.2.3, 7.1, **7.2**, 7.3.2, 8.3.1, 9.3.1.1, 9.10.3, 11.3.1.2, 11.3.4, 11.3.9, 12.1.2
Change Orders, Definition of	7.2.1
Changes	**7.1**
CHANGES IN THE WORK	3.11, 4.6.13, 4.6.14, **7**, 8.3.1, 9.3.1.1, 10.1.3
Claim, Definition of	4.7.1

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Claims and Disputes 4.7, 4.8, 4.9, 6.2.5, 8.3.2, 9.3.1.2, 9.3.3, 9.10.4, 10.1.4
Claims and Timely Assertion of Claims 4.9.6
Claims for Additional Cost 4.7.6, **4.7.7**, 4.7.9, 6.1.1, 10.3
Claims for Additional Time 4.6.9, 4.7.6, **4.7.8**, 4.7.9, 8.3.2
Claims for Concealed or Unknown Conditions 4.7.6
Claims for Damages 3.18, 4.7.9, 6.1.1, 6.2.5, 8.3.2, 9.5.1.2, 10.1.4
Claims Subject to Arbitration 4.7.2, 4.8.4, 4.6.1
Cleaning Up **3.15**, 6.3
Commencement of Statutory Limitation Period **13.7**
Commencement of the Work, Conditions Relating to 2.12 ,2.2.1, 3.2.1, 3.2.2, 3.7.1, 3.10.1 3.12.6, 4.7.7, 5.2.1, 6.2.2, 8.1.2, 8.2.2, 9.2, 11.1.3, 11.3.6, 11.4.1
Commencement of the Work, Definition of 8.1.2
Communications, Owner to Architect 2.2.6
Communications, Owner to Construction Manager 2.2.6
Communications Facilitating Contract Administration 3.9.1 4.6.7, 5.2.1
Completion, Conditions Relating to 3.11, 3.15, 4.6.5, 4.6.16, 4.7.2, 9.4.2, 9.8, 9.9.1, 9.10, 11.3.5, 12.2.2, 13.7.1
COMPLETION, PAYMENTS AND **9**
Completion, Substantial 4.6.16, 4.7.5.2, 8.1.1, 8.1.3, 8.2.3, **9.8**, 9.9.1, 12.2.2, 13.7
Compliance with Laws 1.3, 3.6, 3.7, 3.13, 4.1.1, 10.2.2, 11.1, 11.3, 13.1, 13.5.1, 13.5.2, 13.6, 14.1.1, 14.2.1.3
Concealed or Unknown Conditions 4.7.6
Conditions of the Contract 1.1.1, 1.1.7, 6.1.1
Consent, Written 1.3.1, 3.12.8, 3.14.2, 4.7.4. 4.9.5, 9.3.2, 9.8.2, 9.9.1, 9.10.2, 9.10.3, 10.12, 10.1.3, 11.3.1, 11.3.1.4, 11.3.11, 13.2, 13.4.2
CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS 1.1.4, **6**
Construction Change Directive, Definition of 7.3.1
Construction Change Directives 1.1.1, 4.6.13, 7.1, **7.3**, 9.3.1.1
Construction Manager **4.2**
Construction Manager, and Building Permits 2.2.3
Construction Manager, Claims against 4.7.2
Construction Manager, Communications through 4.6.7
Construction Manager, and Construction Schedule 3.10.1, 3.10.2
Construction Manager, Definition of 4.2.1
Construction Manager, and Documents and Samples at the Site 3.11.1
Construction Manager, Extent of Authority 3.12.6, 3.12.8, 4.3, 4.6.3, 4.6.11, 7.1.2, 7.2.1, 7.3.1, 8.3.1, 9.2.1, 9.3.1, 9.4.1, 9.4.3, 9.8.2, 9.8.3, 9.9.1, 12.1, 12.2.1, 12.2.4, 14.2.2, 14.2.4
Construction Manager, Limitations of Authority 4.6.6, 4.6.10, 13.4.2

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and Responsibility
Construction Manager, and Submittals 3.10.3
Construction Manager's Additional Services and Expenses 12.2.1, 12.2.4
Construction Manager's Administration of the Contract 4.6, 9.4, 9.5
Construction Manager's Approval 2.4.1, 3.10.3
Construction Manager's Authority to Reject Work 4.6.10, 12.2.1
Construction Manager's Decisions 7.3.6, 7.3.7, 7.3.8, 9.3.1, 9.4.1, 9.5.1
Construction Manager's Inspections 4.6.10, 9.4.3, 9.8.2, 9.9.2, 12.1.1
Construction Manager's On-Site Observations 9.5.1
Construction Manager's Relationship with Architect 1.1.2, 4.6.8, 4.6.10, 4.6.11, 4.6.14, 4.6.16, 4.6.18, 6.3.1, 9.2.1, 9.4.2, 9.4.3, 9.51, 9.6.1, 9.6.3, 9.8.2, 9.8.3, 9.9.1, 9.10.1, 9.10.2, 9.10.3, 11.1.3, 12.2.4, 13.5.1, 13.5.2, 13.5.4, 14.2.2, 14.2.4
Construction Manager's Relationship with Contractor 3.2.1, 3.2.2 3.3.1, 3.3.3, 3.5.1, 3.7.3, 3.10.1, 3.10.2, 3.10.3, 3.11.1, 3.12.5, 3.12.6, 3.12.8, 3.12.9, 3.12.10, 3.12.11, 3.13.2, 3.14.2, 3.15.2, 3.16.1, 3.17.1, 3.18.1, 3.18.3, 4.6.3, 4.6.4, 4.6.6, 4.6.11, 5.2, 6.2.1, 6.2.2, 7.1.2, 7.2.1, 7.3.4, 7.3.6, 7.3.9, 8.3.1, 9.2.1,9.3.1, 9.4.1, 9.4.2, 9.4.3, 9.7.1, 9.8.2, 9.9.1, 9.10.1, 9.10.2, 9.10.3, 10.1.1, 10.1.2, 10.1.5, 10.2.6, 11.3.7, 12.1, 13.5.1, 13.5.2, 13.5.3, 13.5.4
Construction Manager's Relationship with Owner 2.2.3, 4.6.1, 4.6.2, 10.1.6
Construction Manager's Relationship with Other Contractors and Owner's Own Forces 4.6.3
Construction Manager's Relationship with Subcontractors 4.6.10, 5.3.1, 9.6.3, 9.6.4
Construction Manager's Representations 9.4.3, 9.5.1
Construction Manager's Site Visits 9.4.4, 9.5.1
Construction Schedules, Contractor's 3.10, 4.6.3, 4.6.4
Contingent Assignment of Subcontracts **5.4**
Continuing Contract Performance **4.7.4**
Contract, Definition of 1.1.2
CONTRACT, TERMINATION OR SUSPENSION OF THE 4.7.7, 5.4.1.1, **14**
Contract Administration 3.3.3, 4, 9.4, 9.5
Contract Award and Execution, Conditions Relating to 3.7.1, 3.10, 5.2,9.2, 11.1.3, 11.3.6, 11.4.1
Contract Documents, The **1.1**, 1.2, 7
Contract Documents, Copies Furnished and Use of 1.3, 2.2.5, 5.3

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User Notes: (2752642138)

Contract Documents, Definition of 1.1.1

Contract Performance During Arbitration 4.7.4, 4.9.3

Contract Sum 3.8, 4.7.6, 4.7.7, 4.8.4, 5.2.3, 7.2, 7.3, 9.1, 9.7, 11.3.1, 12.2.4, 12.3, 14.2.4

Contract Sum, Definition of 9.1.1

Contract Time 4.7.6, 4.7.8.1, 4.8.4, 7.2.1.3, 7.3, 8.2.1, 8.3.1, 9.7, 12.1.1

Contract Time, Definition of 8.1.1

CONTRACTOR 3

Contractor, Definition of 3.1.1, 6.1.2

Contractor's Bid 1.1.1

Contractor's Construction Schedules 3.10

Contractor's Employees 3.3.2, 3.4.2, 3.8.1, 3.9, 3.18, 4.6.6, 4.6.10, 8.1.2, 10.2, 10.3, 11.1.1, 14.2.1.1

Contractor's Liability Insurance 11.1, 11.3.1.5

Contractor's Relationship with Other Contractors and Owner's Own Forces 3.12.5, 3.14.2, 4.6.3, 4.6.7, 12.2.5

Contractor's Relationship with Subcontractors 1.2.4, 3.3.2, 3.18.1, 3.18.2, 5.2, 5.3, 5.4, 9.6.2, 11.3.7, 11.3.8, 14.2.1.2

Contractor's Relationship with the Architect 1.1.2, 3.2.1, 3.2.2, 3.3.3, 3.5.1, 3.7.3, 3.10.1, 3.10.3, 3.11.1, 3.12.6, 3.12.8, 3.12.9, 3.16.1, 3.18, 4.6.6, 4.6.7, 4.6.10, 4.6.12, 4.6.19, 5.2, 6.2.2, 7.3.4, 9.2, 9.3.1, 9.8.2, 9.10.3,10.1.2, 10.1.5, 10.2.6, 11.3.7, 12.1, 13.5

Contractor's Relationship with the Construction Manager 1.1.2, 3.2.1, 3.2.2,3.3.1, 3.3.3, 3.5.1, 3.7.3, 3.7.4, 3.10.1, 3.10.2, 3.10.3, 3.11.1, 3.12.5, 3.12.6, 3.12.8, 3.12.9, 3.12.11, 3.13.2, 3.14.2, 3.15.2, 3.16.1, 3.17.1, 3.18.1, 3.18.3, 4.6.3, 4.6.4, 4.6.6, 5.2, 6.2.1, 6.2.2, 7.1.2, 7.2.1, 7.3.4, 7.3.6, 7.3.9, 8.3.1, 9.2.1, 9.3.1, 9.4.1, 9.4.2, 9.4.3, 9.7.1, 9.8.2, 9.9.1, 9.10.1, 9.10.2, 9.10.3, 10.1.1,10.1.2, 10.1.5, 10.2.6, 11.3.7, 12.1, 13.5.1, 13.5.2, 13.5.3, 13.5.4

Contractor's Representations 1.2.2, 3.5.1, 3.12.7, 6.2.2, 8.2.1, 9.3.3

Contractor's Responsibility for Those Performing the Work 3.3.2, 3.18, 4.6.6, 10

Contractor's Review of Contract Documents 1.2.2, 3.2, 3.7.3

Contractor's Right to Stop the Work 9.7

Contractor's Right to Terminate the Contract 14.1

Contractor's Submittals 3.10, 3.11, 3.12, 4.6.12, 5.2.1, 5.2.3, 7.3.6, 9.2, 9.3.1, 9.8.2, 9.9.1, 9.10.2,

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User Notes: (2752642138)

	9.10.3, 10.1.2, 11.4.2
Contractor's Superintendent	3.9, 10.2.6
Contractor's Supervision and Construction Procedures	1.2.4, 3.3, 3.4, 4.6.6, 8.2.2, 8.2.3, 10
Contractual Liability Insurance	11.1.1.7, 11.2.1, 11.3.1.5
Coordination and Correlation	1.2.2, 1.2.4, 3.3.1, 3.10, 3.12.7, 6.2.1
Copies Furnished of Drawings and Specifications	1.3, 2.2.5, 3.11
Correction of Work	2.3, 2.4, 3.2.1, 4.6.1, 9.8.2, 9.9.1, 12.1.2, 12.2, 13.7.1.3
Cost, Definition of	7.3.6
Costs	2.4, 3.2.1, 3.7.4, 3.8.2, 3.15.2., 4.7.6, 4.7.7, 4.7.8.1, 5.2.3, 6.1.1, 6.2.3, 6.3.1, 7.3.3.3, 7.3.6, 7.3.7, 9.7, 9.8.2, 9.10.2, 11.3.1.2,11.3. 1.3, 11.3.4, 11.3.9, 12.1, 12.2.1, 12.2.4, 12.2.5, 13.5, 14
Cutting and Patching	**3.14**, 6.2.6
Damage to Construction of Owner or Other Contractors	3.14.2, 6.2.4, 9.5.1.5, 10.2.1.2, 10.2.5, 10.3, 11.1, 11.3, 12.2.5
Damage to the Work	3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.3, 11.3
Damages, Claims for	3.18, 4.6.9, 6.1.1, 6.2.5, 8.3.2, 9.5.1.2, 10.1.4
Damages for Delay	6.1.1, 8.3.3, 9.5.1.6, 9.7
Date of Commencement of the Work, Definition of	8.1.2
Date of Substantial Completion, Definition of	8.1.3
Day, Definition of	8.1.4
Decisions of the Architect	4.6, 4.7, 6.3, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.2, 9.9.1, 10.1.2, 13.5.2, 14.2.2, 14.2.4
Decisions of the Construction Manager	4.3, 7.3.6, 7.3.7, 7.3.8, 9.3.1, 9.4.1, 9.4.3, 9.5.1
Decisions to Withhold Certification	**9.5**, 9.7, 14.1.1.3
Defective or Nonconforming Work, Acceptance, Rejection and Correction of	2.3, 2.4, 3.5.1, 4.6.1, 4.6.10, 4.7.5, 9.5, 9.8.2, 9.9.1, 10.2.5, 12, 13.7.1.3
Defective Work, Definition of	3.5.1
Definitions	1.1, 2.1.1, 3.1, 3.5.1, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 4.2.1, 4.7.1, 5.1, 6.1.1, 7.2.1, 7.3.1, 7.3.6, 8.1, 9.1, 9.8.1
Delays and Extensions of Time	4.7.1, 4.7.8.1, 4.7.8.2, 6.1.1, 6.2.3, 7.2.1, 7.3.1.3, 7.3.4, 7.3.5, 7.3.8, 7.3.9, 8.1.1, **8.3**, 10.3.1, 14.1.1.4
Disputes	4.7, 4.8, 4.9, 6.2.5, 6.3, 7.3.8, 9.3.1.2
Documents and Samples at the Site	3.11
Drawings, Definition of	1.1.5
Drawings and Specifications, Use and Ownership of	1.1.1, 1.3,

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User Notes: (2752642138)

	2.2.5, 3.11, 5.3
Duty to Review Contract Documents and Field Conditions	3.2
Effective Date of Insurance	8.2.2, 11.1.2
Emergencies	4.7.7, **10.3**
Employees, Contractor's	3.3.2., 3.4.2, 3.8.1, 3.9, 3.18.1, 3.18.2, 4.6.6, 4.6.10, 8.1.2, 10.2, 10.3, 11.1.1, 14.2.1.1
Equipment, Labor, Materials and	1.1.3, 1.1.6, 3.4, 3.5.1, 3.8.2, 3.12.2, 3.12.3, 3.12.7, 3.12.11, 3.13, 3.15.1, 4.6.12, 6.2.1, 7.3.6, 9.3.2, 9.3.3, 11.3, 12.2.4, 14.1.2, 14.2.1, 14.2.2
Execution and Progress of the Work	1.2.3, 3.4.1, 3.5.1, 4.6.5, 4.6.6, 4.7.4, 4.7.8, 6.2.2, 7.1.3, 8.2, 8.3, 9.5, 9.9.1, 10.2.3, 10.2.4
Execution, Correlation and Intent of the Contract Documents	**1.2**, 3.7.1
Extensions of Time	4.7.1, 4.7.8, 7.2.1.3, 8.3, 10.3.1
Failure of Payment by Contractor	9.5.1.3, 14.2.1.2
Failure of Payment by Owner	4.7.7, 9.7, 14.1.3
Faulty Work (See Defective or Nonconforming Work)	
Final Completion and Final Payment	4.6.1, 4.6.16, 4.7.2, 4.7.5, **9.10**, 11.1.2, 11.1.3, 11.3.5, 12.3.1, 13.7
Financial Arrangements, Owner's	2.2.1
Fire and Extended Coverage Insurance	11.3.1.1, 11.3.5, 11.3.7
GENERAL PROVISIONS	**1**
Governing Law	**13.1**
Guarantees (See Warranty and Warranties)	
Hazardous Materials	10.1, 10.2.4
Identification of Contract Documents	1.2.1
Identification of Subcontractors and Suppliers	5.2.1
Indemnification	3.17, **3.18**, 9.10.2, 10.1.4, 11.3.1.2, 11.3.7
Information and Services Required of the Owner	2.1.2, **2.2**, 4.7.4, 6.2.6, 9.3.2, 9.6.1, 9.6.4, 9.8.3, 9.9.2, 9.10.3, 10.1.4, 11.2, 11.3, 13.5.1, 13.5.2
Injury or Damage to Person or Property	**4.7.9**
Inspections	3.3.3, 3.3.4, 3.7.1, 4.6.5, 4.6.6, 4.6.16, 4.7.6, 9.4.3, 9.8.2, 9.9.2, 9.10.1, 12.1.1, 13.5
Instructions to Bidders	1.1.1
Instructions to the Contractor	3.8.1, 4.6.13, 5.2.1, 7, 12.1, 13.5.2
Insurance	4.7.9, 6.1.1, 7.3.6.4, 9.3.2, 9.8.2, 9.9.1, 9.10.2, 11
Insurance, Boiler and Machinery	**11.3.2**
Insurance, Contractor's Liability	**11.1**, 11.3.1.13
Insurance, Effective Date of	8.2.2, 11.1.2
Insurance, Loss of Use	**11.3.3**
Insurance, Owner's Liability	**11.2**, 11.3.1.3
Insurance, Property	10.2.5, **11.3**
Insurance, Stored Materials	9.3.2, 11.3.1.4
INSURANCE AND BONDS	**11**

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User Notes: (2752642138)

Insurance Companies, Consent to Partial Occupancy 9.9.1, 11.3.11
Insurance Companies, Settlement with 11.3.10
Intent of the Contract Documents 1.2.3, 3.12.4, 4.6.10, 4.6.12, 4.6.19, 4.6.20, 7.4
Interest 13.6
Interpretation 1.2.5, 1.4, **1.5**, 4.1.1, 4.7.1, 5.1, 6.1.2, 8.1.4
Interpretations, Written 4.6.18, 4.6.19, 4.7.7
Joinder and Consolidation of Claims Required 4.9.5
Judgment on Final Award 4.9.1, 4.9.4.1, **4.9.7**
Labor and Materials, Equipment 1.1.3, 1.1.6, **3.4**, 3.5.1, 3.8.2, 3.12.2, 3.12.3, 3.12.7, 3.12.11, 3.13, 3.15.1, 4.6.12, 6.2.1, 7.3.6, 9.3.2, 9.3.3, 12.2.4, 14.1.2, 14.2.1, 14.2.2
Labor Disputes 8.3.1
Laws and Regulations 1.3, 3.6, 3.7, 3.13, 4.1.1, 4.9.5, 4.9.7, 9.9.1, 10.2.2, 11.1, 11.3, 13.1, 13.4.1, 13.5.1, 13.5.2, 13.6
Liens 2.1.2, 4.7.2, 4.7.5.1, 8.2.2, 9.3.3, 9.10.2
Limitation on Consolidation or Joinder 4.9.5
Limitations, Statutes of 4.9.4.2, 12.2.6, 13.7
Limitations of Authority 3.3.1, 4.6.12, 4.6.17, 5.2.2, 5.2.4, 7.4, 11.3.10
Limitations of Liability 2.3, 3.2.1, 3.5.1, 3.7.3, 3.12.8, 3.12.11, 3.17, 3.18, 4.6.10, 4.6.12, 4.6.19, 6.2.2, 9.4.3, 9.6.4, 9.10.4, 10.1.4, 10.2.5, 11.1.2, 11.2.1, 11.3.7, 13.4.2, 13.5.2
Limitations of Time, General 2.2.1, 2.2.4, 3.2.1, 3.7.3, 3.8.2, 3.10, 3.12.5, 3.15.1, 4.6.1, 4.6.12, 4.6.18, 4.7.2, 4.7.3, 4.7.4, 4.7.6, 4.7.9, 4.6.4.2, 5.2.1, 5.2.3, 6.2.4, 7.3.4, 7.4, 8.2, 9.2, 9.5, 9.6.2, 9.8, 9.10, 11.1.3, 11.3.1, 11.3.2, 11.3.5, 11.3.6, 12.2.1, 12.2.2, 13.5, 13.7, 14.3
Limitations of Time, Specific 2.1.2, 2.2.1, 2.4, 3.10, 3.11, 3.15.1, 4.6.1, 4.6.18, 4.7, 4.8, 4.9, 5.3, 5.4, 7.3.5, 7.3.9, 8.2, 9.3.1, 9.3.3, 9.4.1, 9.6.1, 9.7, 9.8.2, 9.10.2, 11.1.3, 11.3.6, 11.3.10, 11.3.11, 12.2.2, 12.2.4, 12.2.6, 13.7, 14.1, 14.2.2
Loss of Use Insurance 11.3.3
Material Suppliers 1.3.1, 3.12.1, 4.6.7, 4.6.10, 5.2.1, 9.3.1, 9.3.1.2, 9.3.3,

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User Notes: (2752642138)

	9.4.3, 9.6.5, 9.10.4
Materials, Hazardous	10.1, 10.2.4
Materials, Labor, Equipment and	1.1.3, 1.1.6, 3.4.1, 3.5.1, 3.8.2, 3.12.2, 3.12.3, 3.12.7, 3.12.11, 3.13, 3.15.1, 4.6.12, 6.2.1, 7.3.6, 9.3.2, 9.3.3, 12.2.4, 14.1.2, 14.2.1, 14.2.2
Means, Methods, Techniques, Sequences and Procedures of Construction	3.3.1, 4.6.6, 4.6.12, 9.4.3
Minor Changes in the Work	1.1.1, 4.6.13, 4.7.7, 7.1, **7.4**
MISCELLANEOUS PROVISIONS	**13**
Modifications, Definition of	1.1.1
Modifications to the Contract	1.1.1, 1.1.2, 3.7.3, 3.11, 4.1.2, 4.6.1, 5.2.3, 7, 8.3.1, 9.7
Mutual Responsibility	**6.2**
Nonconforming Work, Acceptance of	**12.3**
Nonconforming Work, Rejection and Correction of	2.3.1, 4.7.5.2, 9.5.2, 9.8.2, 12, 13.7.1.3
Notice	2.3, 2.4, 3.2.1, 3.2.2, 3.7.3, 3.7.4, 3.9, 3.12.8, 3.12.9, 3.17, 4.7, 4.8.4, 4.9, 5.2.1, 5.3, 5.4.1.1, 8.2.2, 9.4.1, 9.5.1, 9.7, 9.10, 10.1.2, 10.2.6, 11.1.3, 11.3, 12.2.2, 12.2.4, 13.3, 13.5.1, 13.5.2, 14,
Notice, Written	2.3, 2.4, 3.9, 3.12.8, 3.12.9,4.7, 4.8.4, 4.9, 5.2.1, 5.3, 5.4.1.1, 8.2.2, 9.4.1, 9.5.1, 9.7, 9.10, 10.1.2, 10.2.6, 11.1.3, 11.3, 12.2.2, 12.2.4, **13.3**, 13.5.2, 14
Notice of Testing and Inspections	13.5.1, 13.5.2
Notice to Proceed	8.2.2
Notices, Permits, Fees and	2.2.3, **3.7**, 3.13, 7.3.6.4, 10.2.2
Observations, Architect's On-Site	4.6.5, 4.6.9, 4.6.10, 4.7.6, 9.4.4, 9.5.1, 9.10.1, 12.1.1, 13.5
Observations, Construction Manager's On-Site	9.4.4, 12.1.1
Observations, Contractor's Occupancy	1.2.2, 3.2.2 9.6.6, 9.8.1, 9.9, 11.3.11
On-Site Inspections by the Architect	4.6.5, 4.6.16, 4.7.6, 9.4.4, 9.8.2, 9.9.2, 9.10.1
On-Site Observations by the Architect	4.6.5, 4.6.9, 4.7.6, 9.4.4, 9.5.1, 9.10.1, 13.5
On-Site Observations by the Construction Manager	9.4.4, 9.5.1
Orders, Written	2.3, 3.9, 4.7.7, 7, 8.2.2, 11.3.9, 12.1, 12.2, 13.5.2, 14.3.1
Other Contracts and Contractors	1.1.4, 3.14.2, 4.6.7, 4.9.5, 6, 11.3.7, 12.1.2, 12.2.5
OWNER	**2**
Owner, Definition of	2.1
Owner, Information and Services Required of the	2.1.2, **2.2**, 4.6.2, 4.6.4, 6, 9, 10.1.4, 10.1.6, 11.2, 11.3, 13.5.1, 14.1.1.5, 14.1.3
Owner's Authority	3.8.1, 5.2.1, 5.2.4, 5.4.1, 7.3.1, 8.2.2,

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User Notes: (2752642138)

	9.3.1, 9.3.2, 11.4.1, 12.2.4, 13.5.2, 14.2, 14.3.1
Owner's Financial Capability	2.2.1, 14.1.1.5
Owner's Liability Insurance	**11.2**
Owner's Loss of Use Insurance	11.3.3
Owner's Relationship with Subcontractors	1.1.2, 5.2.1, 5.4.1, 9.6.4
Owner's Right to Carry Out the Work	**2.4**, 12.2.4, 14.2.2.2
Owner's Right to Clean Up	**6.3**
Owner's Right to Perform Construction with Own Forces and to Award Other Contracts	**6.1**
Owner's Right to Stop the Work	**2.3**, 4.7.7
Owner's Right to Suspend the Work	14.3
Owner's Right to Terminate the Contract	14.2
Ownership and Use of Architect's Drawings, Specifications and Other Documents	1.1.1, **1.3**, 2.2.5, 5.3
Partial Occupancy or Use	9.6.6, **9.9**, 11.3.11
Patching, Cutting and	**3.14**, 6.2.6
Patents, Royalties and	**3.17**
Payment, Applications for	4.6.9, 9.2, **9.3**, 9.4, 9.5.1, 9.8.3, 9.10.1, 9.10.3, 9.10.4, 14.2.4
Payment, Certificates for	4.6.9, 4.6.16, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7.1, 9.8.3, 9.10.1, 9.10.3, 13.7, 14.1.1.3, 14.2.4
Payment, Failure of	4.7.7, 9.5.1.3, **9.7**, 9.10.2, 14.1.1.3, 14.2.1.2
Payment, Final	4.6.1, 4.6.16, 4.7.2, 4.7.5, **9.10**, 11.1.2., 11.1.3, 11.3.5, 12.3.1
Payment Bond, Performance Bond and	7.3.6.4, 9.10.3, 11.3.9, **11.4**
Payments, Progress	4.7.4, 9.3, **9.6**, 9.8.3, 9.10.3, 13.6, 14.2.3
PAYMENTS AND COMPLETION	**9**, 14
Payments to Subcontractors	5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 11.3.8, 14.2.1.2
PCB	10.1.2, 10.1.3, 10.1.4
Performance Bond and Payment Bond	7.3.6.4, 9.10.3, 11.3.9, 11.4
Permits, Fees and Notices	2.2.3, **3.7**, 3.13, 7.3.6.4, 10.2.2
PERSONS AND PROPERTY, PROTECTION OF	**10**
Polychlorinated Biphenyl	10.1.2, 10.1.3, 10.1.4
Product Data, Definition of	3.12.2
Product Data and Samples, Shop Drawings	3.11, **3.12**, 4.2.7
Progress and Completion	4.6.5, 4.7.4, **8.2**
Progress Payments	4.7.4, 9.3, **9.6**, 9.8.3, 9.10.3, 13.6, 14.2.3
Project, Definition of the	**1.1.4**
Project Manual, Definition of the	**1.1.7**
Project Manuals	2.2.5
Project Representatives	4.6.17
Property Insurance	10.2.5, **11.3**
PROTECTION OF PERSONS AND PROPERTY	**10**
Regulations and Laws	1.3, 3.6, 3.7, 3.13, 4.1.1, 4.9.7, 10.2.2, 11.1, 11.3, 13.1, 13.4, 13.5.1, 13.5.2, 13.6, 14
Rejection of Work	3.5.1, 4.6.10, 12.2.
Releases of Waivers and Liens	9.10.2

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User Notes: (2752642138)

Representations 1.2.2, 3.5.1, 3.12.7, 6.2.2, 8.2.1, 9.3.3, 9.4.3, 9.5.1, 9.8.2, 9.10.1
Representatives 2.1.1, 3.1.1, 3.9, 4.1.1, 4.6.1, 4.6.17, 5.1.1, 5.1.2, 13.2.1
Resolution of Claims and Disputes **4.8**, 4.9
Responsibility for Those Performing the Work 3.3.2, 4.6.6, 6.2., 10
Retainage 9.3.1, 9.6.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3
Review of Contract Documents and Field Conditions by Contractor 1.2.2, **3.2**, 3.7.3, 3.12.7
Review of Contractor's Submittals by Owner, Construction Manager and Architect 3.10.1, 3.10.3, 3.11, 3.12, 4.6.12. 4.6.16, 5.2.1, 5.2.3, 9.2, 9.8.2
Review of Shop Drawings, Product Data and Samples by Contractor 3.12.5
Rights and Remedies 1.1.2, 2.3, 2.4, 3.5.1, 3.15.2, 4.6.10, 4.7.6, 4.9, 5.3, 6.1, 6.3, 7.3.1, 8.3.1, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.2, 12. 2.4, **13.4**, 14
Royalties and Patents **3.17**
Rules and Notices for Arbitration **4.9.2**
Safety of Persons and Property **10.2**
Safety Precautions and Programs 4.6.6, 4.6.12, **10.1**
Samples, Definition of 3.12.3
Samples, Shop Drawings, Product Data and Samples at the Site, Documents and 3.11, **3.12**, 4.6.12 **3.11**
Schedule of Values **9.2**, 9.3.1
Schedules, Construction 3.10
Separate Contracts and Contractors 1.1.4
Shop Drawings, Definition of 3.12.1
Shop Drawings, Product Data and Samples 3.11, **3.12**, 4.6.11, 4.6.12, 4.6.15
Site, Use of 3.13, 6.1.1, 6.2.1
Site Inspections 1.2.2, 3.3.4, 4.6.5, 4.6.16, 4.7.6, 9.8.2, 9.10.1, 13.5
Site Visits, Architect's 4.6.5, 4.6.9, 4.7.6, 9.4, 9.5.1, 9.8.2, 9.9.2, 9.10.1, 13.5
Special Inspections and Testing 4.6.10, 12.2.1, 13.5
Specifications, Definition of the **1.1.6**
Specifications, The 1.1.1, **1.1.6**, 1.1.7, 1.2.4, 1.3, 3.11
Statute of Limitations 4.9.4.2, 12.2.6, 13.7
Stopping the Work 2.3, 4.7.7, 9.7, 10.1.2, 10.3, 14.1
Stored Materials 6.2.1, 9.3.2, 10.2.1.2, 11.3.1.4, 12.2.4
Subcontractor, Definition of 5.1.1
SUBCONTRACTORS **5**
Subcontractors, Work by 1.2.4, 3.3.2, 3.12.1, 4.6.6, 4.6.10, 5.3, 5.4
Subcontractual Relations **5.3**, 5.4, 9.3.1.2, 9.6.2, 9.6.3, 9.6.4, 10.2.1, 11.3.7, 11.3.8, 14.1.1, 14.2.1.2, 14.1.3
Submittals 1.3, 3.2.3, 3.10, 3.11, 3.12, 4.6.12, 5.2.1, 5.2.3, 7.3.6, 9.2, 9.3.1, 9.8.2, 9.9.1, 9.10.2, 9.10.3, 11.1.3

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User Notes: (2752642138)

Subrogation, Waivers of 6.1.1, 11.3.5, **11.3.7**
Substantial Completion 4.6.16, 8.1.1, 8.1.3, 8.2.3, **9.8**, 9.9.1, 12.2.1, 12.2.2, 13.7
Substantial Completion, Definition of 9.8.1
Substitution of Subcontractors 5.2.3, 5.2.4
Substitution of Architect 4.4
Substitution of Construction Manager 4.4
Substitutions of Materials 3.5.1
Sub-subcontractor, Definition of 5.1.2
Subsurface Conditions 4.7.6
Successors and Assigns **13.2**
Superintendent **3.9**, 10.2.6
Supervision and Construction Procedures 1.2.4, **3.3**, 3.4, 4.6.6, 4.7.4, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 10, 12, 14
Surety 4.8.1, 4.8.4, 5.4.1.2, 9.10.2, 9.10.3, 14.2.2
Surety, Consent of 9.10.2, 9.10.3
Surveys 2.2.2, 3.18.3
Suspension by the Owner for Convenience **14.3**
Suspension of the Work 4.7.7, 5.4.2, 14.1.1.4, 14.3
Suspension or Termination of the Contract 4.7.7, 5.4.1.1, 14
Taxes **3.6**, 7.3.6.4
Termination by the Contractor **14.1**
Termination by the Owner for Cause 5.4.1.1, **14.2**
Termination of the Architect 4.4
Termination of the Construction Manager 4.4
Termination of the Contractor 14.2.2
TERMINATION OR SUSPENSION OF THE CONTRACT **14**
Tests and Inspections 3.3.3, 4.6.10, 4.6.16, 9.4.3, 12.2.1, **13.5**
TIME **8**
Time, Delays and 4.7.8, 7.2.1,
Extensions of **8.3**
Time Limits, Specific 2.1.2, 2.2.1, 2.4, 3.10, 4.6.18, 4.7, 4.8.1, 4.8.3, 4.8.4, 4.9.1, 4.9.4.1, 4.9.4.2, 5.3, 5.4, 7.3.5, 7.3.9, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.6.1, 9.7, 9.8.2, 9.10.2, 11.1.3, 11.3.6, 11.3.10, 11.3.11, 12.2.2, 12.2.4, 12.2.6, 13.7, 14
Time Limits on Claims 4.7.2, **4.7.3**, 4.7.6, 4.7.9, 4.8, 4.9
Title to Work 9.3.2, 9.3.3
UNCOVERING AND CORRECTION OF WORK **12**
Uncovering of Work **12.1**
Unforeseen Conditions 4.7.6, 8.3.1, 10.1
Unit Prices 7.1.4, 7.3.3.2
Use of Documents 1.1.1, 1.3, 2.2.5, 3.12.7, 5.3
Use of Site **3.13**, 6.1.1, 6.2.1
Values, Schedule of **9.2**, 9.3.1
Waiver of Claims: Final Payment **4.7.5**, 4.9.1, 9.10.3
Waiver of Claims by the Architect 13.4.2
Waiver of Claims by the Contractor 9.10.4, 11.3.7, 13.4.2
Waiver of Claims by the Owner 4.7.5, 4.9.1, 9.9.3, 9.10.3, 11.3.3, 11.3.5, 11.3.7, 13.4.2
Waiver of Liens 9.10.2
Waivers of Subrogation 6.1.1, 11.3.5, **11.3.7**
Warranty and Warranties **3.5**, 4.6.16, 4.7.5, 9.3.3, 9.8.2, 9.9.1, 12.2.2,

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	13.7.1.3
Weather Delays	4.7.8.2
When Arbitration May Be Demanded	**4.9.4**
Work, Definition of	1.1.3
Written Consent	1.3.1, 3.12.8, 3.14.2, 4.7.4, 4.9.5, 9.3.2, 9.8.2, 9.9.1, 9.10.2, 9.10.3, 10.1.2, 10.1.3, 11.3.1, 11.3.1.4, 11.3.11, 13.2, 13.4.2
Written Interpretations	4.6.18, 4.6.19, 4.7.7
Written Notice	2.3, 2.4, 3.9, 3.12.8, 3.12.9, 4.7.1, 4.7.6, 4.7.9, 4.8.4, 4.9.4.1, 5.2.1, 5.3, 5.4.1.1, 8.2.2, 9.4, 9.5.1, 9.7, 9.10, 10.1.2, 10.2.6, 11.1.3, 11.3, 12.2.2, 12.2.4, **13.3**, 13.5.2, 14
Written Orders	2.3, 3.9, 4.7.7, 8.2.2, 11.3.9, 12.1, 12.2, 13.5.2, 14.3.1

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the Agreement), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents such as bidding requirements (advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of addenda relating to bidding requirements).

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Architect and Contractor, (2) between the Construction Manager and Contractor, (3) between the Architect and Construction Manager, (4) between the Owner and a Subcontractor or Sub-subcontractor or (5) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Contractors and by the Owner's own forces including persons or entities under separate contracts not administered by the Construction Manager.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 THE PROJECT MANUAL

The Project Manual is the volume usually assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

§ 1.2 EXECUTION, CORRELATION AND INTENT

§ 1.2.1 The Contract Documents shall be signed by the Owner and Contractor as provided in the Agreement. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

§ 1.2.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 1.2.3 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

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consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

§ 1.2.4 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.5 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 OWNERSHIP AND USE OF ARCHITECT'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS

§ 1.3.1 The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect's service through which the Work to be executed by the Contractor is described. The Contractor may retain one contract record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect, and unless otherwise indicated the Architect shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyright. All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner and Architect. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's copyright or other reserved rights.

§ 1.4 CAPITALIZATION

§ 1.4.1 Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.5 INTERPRETATION

§ 1.5.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

ARTICLE 2 OWNER

§ 2.1 DEFINITION

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner upon reasonable written request shall furnish to the Contractor in writing information which is necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein at the time of execution of the Agreement and, within five days after any change, information of such change in title, recorded or unrecorded.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 The Owner shall, at the request of the Contractor, prior to execution of the Agreement and promptly from time to time thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract.
[Note: Unless such reasonable evidence were furnished on request prior to the execution of the Agreement, the prospective contractor would not be required to execute the Agreement or to commence the Work.]

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§ 2.2.2 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site.

§ 2.2.3 Except for permits and fees which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Unless otherwise provided under the Contract Documents, the Owner, through the Construction Manager, shall secure and pay for the building permit.

§ 2.2.4 Information or services under the Owner's control shall be furnished by the Owner with reasonable promptness to avoid delay in orderly progress of the Work.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work.

§ 2.2.6 The Owner shall forward all communications to the Contractor through the Construction Manager and shall contemporaneously provide the same communications to the Architect.

§ 2.2.7 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Article 6 (Construction by Owner or by Other Contractors), Article 9 (Payments and Completion) and Article 11 (Insurance and Bonds).

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

§ 2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or persistently fails to carry out Work in accordance with the Contract Documents, the Owner, by written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

§ 2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a second seven-day period. If the Contractor within such second seven-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Construction Manager's and Architect's and their respective consultants' additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect, after consultation with the Construction Manager. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 DEFINITION

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout this Agreement as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The plural term "Contractors" refers to persons or entities who perform construction under Conditions of the Contract that are administered by the Construction Manager, and that are identical or substantially similar to these Conditions.

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§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Section 2.2.2 and shall at once report to the Construction Manager and Architect errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner, Construction Manager or Architect for damage resulting from errors, inconsistencies or omissions in the Contract Documents unless the Contractor recognized such error, inconsistency or omission and knowingly failed to report it to the Construction Manager and Architect. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Construction Manager and Architect, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

§ 3.2.2 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Construction Manager and Architect at once.

§ 3.2.3 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Section 3.12.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under this Contract, subject to overall coordination of the Construction Manager as provided in Sections 4.6.3 and 4.6.4.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

§ 3.3.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

§ 3.3.4 The Contractor shall inspect portions of the Project related to the Contractor's Work in order to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

§ 3.5 WARRANTY

§ 3.5.1 The Contractor warrants to the Owner, Construction Manager and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

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§ 3.6 TAXES

§ 3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES AND NOTICES

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner shall secure and pay for the building permit and the Contractor shall secure and pay for all other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules and regulations and lawful orders of public authorities bearing on performance of the Work.

§ 3.7.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Construction Manager, Architect and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

§ 3.7.4 If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Construction Manager, Architect and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents:

.1 materials and equipment under an allowance shall be selected promptly by the Owner to avoid delay in the Work;

.2 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.3 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum and not in the allowances;

.4 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.2 and (2) changes in Contractor's costs under Section 3.8.2.3.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULE

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's Construction Schedule for the Work. Such schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project construction schedule to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

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§ 3.10.2 The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict, delay in or interference with the Work of other Contractors or the construction or operations of the Owner's own forces.

§ 3.10.3 The Contractor shall prepare and keep current, for the Construction Manager's and Architect's approval, a schedule of submittals which is coordinated with the Contractor's Construction Schedule and allows the Construction Manager and Architect reasonable time to review submittals.

§ 3.10.4 The Contractor shall conform to the most recent schedules.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

§ 3.11.1 The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, addenda, Change Orders and other Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Construction Manager and Architect and shall be delivered to the Construction Manager for submittal to the Owner upon completion of the Work.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect is subject to the limitations of Section 4.6.12.

§ 3.12.5 The Contractor shall review, approve and submit to the Construction Manager, in accordance with the schedule and sequence approved by the Construction Manager, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples and similar submittals with related documents submitted by other Contractors. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action.

§ 3.12.6 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Construction Manager and Architect. Such Work shall be in accordance with approved submittals.

§ 3.12.7 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.8 The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Construction Manager's and Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Construction Manager and Architect in writing of such deviation at the time of submittal and the Construction Manager and Architect have given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Construction Manager's and Architect's approval thereof.

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§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals.

§ 3.12.10 Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents.

§ 3.12.11 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Construction Manager and Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

§ 3.13 USE OF SITE

§ 3.13.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner's own forces or of other Contractors by cutting, patching, excavating or otherwise altering such construction. The Contractor shall not cut or otherwise alter such construction by other Contractors or by the Owner's own forces except with written consent of the Construction Manager, Owner and such other Contractors; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the other Contractors or the Owner the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Construction Manager may do so with the Owner's approval and the cost thereof shall be charged to the Contractor.

§ 3.16 ACCESS TO WORK

§ 3.16.1 The Contractor shall provide the Owner, Construction Manager and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES AND PATENTS

§ 3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the Owner, Construction Manager and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by

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negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Section 3.18 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

§ 3.18.3 The obligations of the Contractor under this Section 3.18 shall not extend to the liability of the Construction Manager, Architect, their consultants, and agents and employees of any of them arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Construction Manager, Architect, their consultants, and agents and employees of any of them provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

§ 4.1 ARCHITECT

§ 4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

§ 4.2 CONSTRUCTION MANAGER

§ 4.2.1 The Construction Manager is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Construction Manager" means the Construction Manager or the Construction Manager's authorized representative.

§ 4.3 Duties, responsibilities and limitations of authority of the Construction Manager and Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Construction Manager, Architect and Contractor. Consent shall not be unreasonably withheld.

§ 4.4 In case of termination of employment of the Construction Manager or Architect, the Owner shall appoint a construction manager or architect against whom the Contractor makes no reasonable objection and whose status under the Contract Documents shall be that of the former construction manager or architect, respectively.

§ 4.5 Disputes arising under Sections 4.3 and 4.4 shall be subject to arbitration.

§ 4.6 ADMINISTRATION OF THE CONTRACT

§ 4.6.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents, and will be the Owner's representatives (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the correction period described in Section 12.2. The Construction Manager and Architect will advise and consult with the Owner and will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument in accordance with other provisions of the Contract.

§ 4.6.2 The Construction Manager will determine in general that the Work is being performed in accordance with the requirements of the Contract Documents, will keep the Owner informed of the progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work.

§ 4.6.3 The Construction Manager will provide for coordination of the activities of other Contractors and of the Owner's own forces with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other Contractors and the Construction Manager and Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed

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necessary after a joint review and mutual agreement. The construction schedules shall constitute the schedules to be used by the Contractor, other Contractors, the Construction Manager and the Owner until subsequently revised.

§ 4.6.4 The Construction Manager will schedule and coordinate the activities of the Contractors in accordance with the latest approved Project construction schedule.

§ 4.6.5 The Architect will visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine in general if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check quality or quantity of the Work. On the basis of on-site observations as an architect, the Architect will keep the Owner informed of progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work.

§ 4.6.6 The Construction Manager, except to the extent required by Section 4.6.4, and Architect will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Section 3.3, and neither will be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of or be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

§ 4.6.7 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall communicate through the Construction Manager, and shall contemporaneously provide the same communications to the Architect. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect.

§ 4.6.8 The Construction Manager will review and certify all Applications for Payment by the Contractor, including final payment. The Construction Manager will assemble each of the Contractor's Applications for Payment with similar Applications from other Contractors into a Project Application and Project Certificate for Payment. After reviewing and certifying the amounts due the Contractors, the Construction Manager will submit the Project Application and Project Certificate for Payment, along with the applicable Contractors' Applications and Certificates for Payment, to the Architect.

§ 4.6.9 Based on the Architect's observations and evaluations of Contractors' Applications for Payment, and the certifications of the Construction Manager, the Architect will review and certify the amounts due the Contractors and will issue a Project Certificate for Payment.

§ 4.6.10 The Architect will have authority to reject Work which does not conform to the Contract Documents, and to require additional inspection or testing, in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed, but will take such action only after notifying the Construction Manager. Subject to review by the Architect, the Construction Manager will have the authority to reject Work which does not conform to the Contract Documents. Whenever the Construction Manager considers it necessary or advisable for implementation of the intent of the Contract Documents, the Construction Manager will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.6.18 through 4.6.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.6.10 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.6.11 The Construction Manager will receive from the Contractor and review and approve all Shop Drawings, Product Data and Samples, coordinate them with information received from other Contractors, and transmit to the

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Architect those recommended for approval. The Construction Manager's actions will be taken with such reasonable promptness as to cause no delay in the Work of the Contractor or in the activities of other Contractors, the Owner, or the Architect.

§ 4.6.12 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken with such reasonable promptness as to cause no delay in the Work of the Contractor or in the activities of the other Contractors, the Owner, or the Construction Manager, while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.6.13 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.6.14 Following consultation with the Construction Manager, the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7 and will have authority to order minor changes in the Work as provided in Section 7.4.

§ 4.6.15 The Construction Manager will maintain at the site for the Owner one record copy of all Contracts, Drawings, Specifications, addenda, Change Orders and other Modifications, in good order and marked currently to record all changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

§ 4.6.16 The Construction Manager will assist the Architect in conducting inspections to determine the dates of Substantial Completion and final completion, and will receive and forward to the Architect written warranties and related documents required by the Contract and assembled by the Contractor. The Construction Manager will forward to the Architect a final Project Application and Project Certificate for Payment upon compliance with the requirements of the Contract Documents.

§ 4.6.17 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.6.18 The Architect will interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of the Construction Manager, Owner or Contractor. The Architect's response to such requests will be made with reasonable promptness and within any time limits agreed upon. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.6, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

§ 4.6.19 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

§ 4.6.20 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

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§ 4.7 CLAIMS AND DISPUTES

§ 4.7.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be made by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 4.7.2 Decision of Architect. Claims, including those alleging an error or omission by the Construction Manager or Architect, shall be referred initially to the Architect for action as provided in Section 4.8. A decision by the Architect, as provided in Section 4.8.4, shall be required as a condition precedent to arbitration or litigation of a Claim between the Contractor and Owner as to all such matters arising prior to the date final payment is due, regardless of (1) whether such matters relate to execution and progress of the Work or (2) the extent to which the Work has been completed. The decision by the Architect in response to a Claim shall not be a condition precedent to arbitration or litigation in the event (1) the position of Architect is vacant, (2) the Architect has not received evidence or has failed to render a decision within agreed time limits, (3) the Architect has failed to take action required under Section 4.8.4 within 30 days after the Claim is made, (4) 45 days have passed after the Claim has been referred to the Architect or (5) the Claim relates to a mechanic's lien.

§ 4.7.3 Time Limits on Claims. Claims by either party must be made within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner.

§ 4.7.4 Continuing Contract Performance. Pending final resolution of a Claim including arbitration, unless otherwise agreed in writing the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 4.7.5 Waiver of Claims: Final Payment. The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

.1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents; or
.3 terms of special warranties required by the Contract Documents.

§ 4.7.6 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 days after the Architect has given notice of the decision. If the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Section 4.8.

§ 4.7.7 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.3. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with the procedure established herein.

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§ 4.7.8 Claims for Additional Time.

§ 4.7.8.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

§ 4.7.8.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction.

§ 4.7.9 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in Sections 4.7.7 or 4.7.8.

§ 4.8 RESOLUTION OF CLAIMS AND DISPUTES

§ 4.8.1 The Architect will review Claims and take one or more of the following preliminary actions within ten days of receipt of a Claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Architect expects to take action, (3) reject the Claim in whole or in part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The Architect may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

§ 4.8.2 If a Claim has been resolved, the Architect will prepare or obtain appropriate documentation.

§ 4.8.3 If a Claim has not been resolved, the party making the Claim shall, within ten days after the Architect's preliminary response, take one or more of the following actions: (1) submit additional supporting data requested by the Architect, (2) modify the initial Claim or (3) notify the Architect that the initial Claim stands.

§ 4.8.4 If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven days, which decision shall be final and binding on the parties but subject to arbitration. Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor's default, the Architect may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 4.9 ARBITRATION

§ 4.9.1 Controversies and Claims Subject to Arbitration. Any controversy or Claim arising out of or related to the Contract, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator or arbitrators may be entered in any court having jurisdiction thereof, except controversies or Claims relating to aesthetic effect and except those waived as provided for in Section 4.7.5. Such controversies or Claims upon which the Architect has given notice and rendered a decision as provided in Section 4.8.4 shall be subject to arbitration upon written demand of either party. Arbitration may be commenced when 45 days have passed after a Claim has been referred to the Architect as provided in Section 4.7 and no decision has been rendered.

§ 4.9.2 Rules and Notices for Arbitration. Claims between the Owner and Contractor not resolved under Section 4.8 shall, if subject to arbitration under Section 4.9.1, be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect, unless the parties mutually agree otherwise. Notice of demand for arbitration shall be filed in writing with the other party to the Agreement between the Owner and Contractor and with the American Arbitration Association, and copies shall be filed with the Construction Manager and Architect.

§ 4.9.3 Contract Performance During Arbitration. During arbitration proceedings, the Owner and Contractor shall comply with Section 4.7.4.

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§ 4.9.4 When Arbitration May Be Demanded. Demand for arbitration of any Claim may not be made until the earlier of (1) the date on which the Architect has rendered a final written decision on the Claim, (2) the tenth day after the parties have presented evidence to the Architect or have been given reasonable opportunity to do so, if the Architect has not rendered a final written decision by that date, or (3) any of the five events described in Section 4.7.2.

§ 4.9.4.1 When a written decision of the Architect states that (1) the decision is final but subject to arbitration and (2) a demand for arbitration of a Claim covered by such decision must be made within 30 days after the date on which the party making the demand receives the final written decision, then failure to demand arbitration within said 30 days' period shall result in the Architect's decision becoming final and binding upon the Owner and Contractor. If the Architect renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence, but shall not supersede arbitration proceedings unless the decision is acceptable to all parties concerned.

§ 4.9.4.2 A demand for arbitration shall be made within the time limits specified in Sections 4.9.1 and 4.9.4 and Section 4.9.4.1 as applicable, and in other cases within a reasonable time after the Claim has arisen, and in no event shall it be made after the date when institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations as determined pursuant to Section 13.7.

§ 4.9.5 Limitation on Consolidation or Joinder. No arbitration arising out of or relating to the Contract Documents shall include, by consolidation or joinder or in any other manner, the Construction Manager, the Architect, or the Construction Manager's or Architect's employees or consultants, except by written consent containing specific reference to the Agreement and signed by the Construction Manager, Architect, Owner, Contractor and any other person or entity sought to be joined. No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the Owner, Contractor, other Contractors as described in Article 6 and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in arbitration. No persons or entities other than the Owner, Contractor or other Contractors as defined in Section 3.1.2 shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a dispute not described therein or with a person or entity not named or described therein. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 4.9.6 Claims and Timely Assertion of Claims. A party who files a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded. When a party fails to include a Claim through oversight, inadvertence or excusable neglect, or when a Claim has matured or been acquired subsequently, the arbitrator or arbitrators may permit amendment.

§ 4.9.7 Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include other Contractors or subcontractors of other Contractors.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Construction Manager for review by the Owner, Construction Manager and Architect the names of persons or entities (including those who are to furnish

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materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Construction Manager will promptly reply to the Contractor in writing stating whether or not the Owner, Construction Manager or Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Construction Manager to reply promptly shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. The Contract Sum shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued. However, no increase in the Contract Sum shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such change.

§ 5.3 SUBCONTRACTUAL RELATIONS

§ 5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

§ 5.4.2 If the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION WITH OWN FORCES AND TO AWARD OTHER CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, which include persons or entities under separate contracts not administered by the Construction Manager. The Owner further reserves the right to award other contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided elsewhere in the Contract Documents.

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§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces including persons or entities under separate contracts not administered by the Construction Manager, the Owner shall provide for coordination of such forces with the Work of the Contractor, who shall cooperate with them.

§ 6.1.3 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in this Article 6 and in Articles 3, 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner's own forces, Construction Manager and other Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner's own forces or other Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Construction Manager and Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's own forces or other Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor.

§ 6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed construction or partially completed construction or to property of the Owner or other Contractors as provided in Section 10.2.5.

§ 6.2.5 Claims and other disputes and matters in question between the Contractor and other Contractors shall be subject to the provisions of Section 4.7 provided the other Contractors have reciprocal obligations.

§ 6.2.6 The Owner and other Contractors shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

§ 6.3.1 If a dispute arises among the Contractor, other Contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish as described in Section 3.15, the Owner may clean up and allocate the cost among those responsible as the Construction Manager, in consultation with the Architect, determines to be just.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 CHANGES

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Construction Manager, Architect and Contractor; a Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

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§ 7.1.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect and Contractor, stating their agreement upon all of the following:

.1 a change in the Work;
.2 the amount of the adjustment in the Contract Sum, if any; and
.3 the extent of the adjustment in the Contract Time, if any.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager and Architect, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 unit prices stated in the Contract Documents or subsequently agreed upon;
.3 cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 as provided in Section 7.3.6.

§ 7.3.4 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Construction Manager and Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.5 A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.6 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Construction Manager on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.6 shall be limited to the following:

.1 costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers compensation insurance;
.2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
.3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

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.4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.7 Pending final determination of cost to the Owner, amounts not in dispute may be included in Applications for Payment. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.8 If the Owner and Contractor do not agree with the adjustment in Contract Time or the method for determining it, the adjustment or the method shall be referred to the Construction Manager for determination.

§ 7.3.9 When the Owner and Contractor agree with the determination made by the Construction Manager concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately issued through the Construction Manager and shall be recorded by preparation and execution of an appropriate Change Order.

§ 7.4 MINOR CHANGES IN THE WORK

§ 7.4.1 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order issued through the Construction Manager and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in progress of the Work by an act or neglect of the Owner's own forces, Construction Manager, Architect, any of the other Contractors or an employee of any of them, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner pending arbitration, or by other causes which

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the Architect, based on the recommendation of the Construction Manager, determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Section 4.7.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

§ 9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect, through the Construction Manager, a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least fifteen days before the date established for each progress payment, the Contractor shall submit to the Construction Manager an itemized Application for Payment for Work completed in accordance with the schedule of values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner, Construction Manager or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for elsewhere in the Contract Documents.

§ 9.3.1.1 Such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders.

§ 9.3.1.2 Such applications may not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier because of a dispute or other reason.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Construction Manager will assemble a Project Application for Payment by combining the Contractor's applications with similar applications for progress payments from other Contractors and, after certifying the amounts due on such applications, forward them to the Architect within seven days.

§ 9.4.2 Within seven days after the Architect's receipt of the Project Application for Payment, the Construction Manager and Architect will either issue to the Owner a Project Certificate for Payment, with a copy to the Contractor, for such amount as the Construction Manager and Architect determine is properly due, or notify the Contractor and Owner in writing of the Construction Manager's and Architect's reasons for withholding

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certification in whole or in part as provided in Section 9.5.1. Such notification will be forwarded to the Contractor by the Construction Manager.

§ 9.4.3 The issuance of a separate Certificate for Payment or a Project Certificate for Payment will constitute representations made separately by the Construction Manager and Architect to the Owner, based on their individual observations at the site and the data comprising the Application for Payment submitted by the Contractor, that the Work has progressed to the point indicated and that, to the best of the Construction Manager's and Architect's knowledge, information and belief, quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the Construction Manager or Architect. The issuance of a separate Certificate for Payment or a Project Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a separate Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed the Contractor's construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Construction Manager or Architect may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.3 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager or Architect will notify the Contractor and Owner as provided in Section 9.4.2. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Construction Manager and Architect will promptly issue a Certificate for Payment for the amount for which the Construction Manager and Architect are able to make such representations to the Owner. The Construction Manager or Architect may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss because of:

.1 defective Work not remedied;
.2 third party claims filed or reasonable evidence indicating probable filing of such claims;
.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or another contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 persistent failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Construction Manager and Architect have issued a Project Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Construction Manager and Architect.

§ 9.6.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in similar manner.

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§ 9.6.3 The Construction Manager will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

§ 9.6.4 Neither the Owner, Construction Manager nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 Payment to material suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.7 FAILURE OF PAYMENT

§ 9.7.1 If, through no fault of the Contractor, 1) the Construction Manager and Architect do not issue a Project Certificate for Payment within fourteen days after the Construction Manager's receipt of the Contractor's Application for Payment or 2) the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Construction Manager and Architect or awarded by arbitration, then the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, which shall be accomplished as provided in Article 7.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor and Construction Manager shall jointly prepare and submit to the Architect a comprehensive list of items to be completed or corrected. The Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. The Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

§ 9.8.3 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Construction Manager and Architect, the Owner shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.11 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments,

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retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect after consultation with the Construction Manager.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a written notice that the Work is ready for final inspection and acceptance and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager will forward the notice and Application to the Architect who will promptly make such inspection. When the Architect, based on the recommendation of the Construction Manager, finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their observations and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in said final Certificate is due and payable. The Construction Manager's and Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or other wise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect through the Construction Manager prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims. The making of final payment shall constitute a waiver of Claims by the Owner as provided in Section 4.4.5.

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§ 9.10.4 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment. Such waivers shall be in addition to the waiver described in Section 4.7.5.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

§ 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors.

§ 10.1.2 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner, Construction Manager and Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless, by written agreement of the Owner and Contractor, or in accordance with final determination by the Architect on which arbitration has not been demanded, or by arbitration under Article 4.

§ 10.1.3 The Contractor shall not be required pursuant to Article 7 to perform without consent any Work relating to asbestos or polychlorinated biphenyl (PCB).

§ 10.1.4 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Construction Manager, Architect, their consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Owner, anyone directly or indirectly employed by the Owner or anyone for whose acts the Owner may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 10.1.4.

§ 10.1.5 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner, Construction Manager and Architect in writing. The Owner, Contractor, Construction Manager and Architect shall then proceed in the same manner described in Section 10.1.2.

§ 10.1.6 The Owner shall be responsible for obtaining the services of a licensed laboratory to verify a presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the persons or entities proposed by the Owner. If the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager and the Architect have no reasonable objection.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

.1 employees on the Work and other persons who may be affected thereby;

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.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors;

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction; and

.4 construction or operations by the Owner or other Contractors.

§ 10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use for storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4, except damage or loss attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner, Construction Manager and Architect.

§ 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

§ 10.3 EMERGENCIES

§ 10.3.1 In an emergency affecting safety or persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Section 4.7 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 claims under workers compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;

.2 claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 claims for damages insured by usual personal injury liability coverage which are sustained (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (2) by another person;

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.5 claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and

.7 claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be submitted to the Construction Manager for transmittal to the Owner with a copy to the Architect prior to commencement of the Work. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Section 9.10.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

§ 11.2 OWNER'S LIABILITY INSURANCE

§ 11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance. Optionally, the Owner may purchase and maintain other insurance for self-protection against claims which may arise from operations under the Contract. The Contractor shall not be responsible for purchasing and maintaining this optional Owner's liability insurance unless specifically required by the Contract Documents.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance in the amount of the initial Contract Sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis without voluntary deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is earlier. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Work.

§ 11.3.1.1 Property insurance shall be on an "all-risk" policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, falsework, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's services and expenses required as a result of such insured loss. Coverage for other perils shall not be required unless otherwise provided in the Contract Documents.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance which will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires minimum deductibles and such deductibles are identified in the Contract Documents, the Contractor shall pay costs not covered because of such deductibles. If the Owner or insurer increases the required minimum deductibles above the amounts so identified or if the Owner elects to purchase this

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insurance with voluntary deductible amounts, the Owner shall be responsible for payment of the additional costs not covered because of such increased or voluntary deductibles.

§ 11.3.1.4 Unless otherwise provided in the Contract Documents, this property insurance shall cover portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also portions of the Work in transit.

§ 11.3.1.5 The insurance required by this Section 11.3 is not intended to cover machinery, tools or equipment owned or rented by the Contractor which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment which shall be subject to the provisions of Section 11.3.7.

§ 11.3.2 Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or for other special hazards be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, adjoining or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other perils covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 Waivers of Subrogation. The Owner and Contractor waive all rights against each other and against the Construction Manager, Architect, Owner's other Contractors and own forces described in Article 6, if any, and the subcontractors, sub-subcontractors, consultants, agents and employees of any of them, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as the Owner and Contractor may have to the proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, Owner's separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of

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insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or in accordance with an arbitration award in which case the procedure shall be as provided in Section 4.9. If after such loss no other special agreement is made, replacement of damaged property shall be covered by appropriate Change Order.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection be made, arbitrators shall be chosen as provided in Section 4.9. The Owner as fiduciary shall, in that case, make settlement with insurers in accordance with directions of such arbitrators. If distribution of insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

§ 11.3.11 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by either, be uncovered for their observation and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered which the Construction Manager or Architect has not specifically requested to observe prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or one of the other Contractors in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such rejected Work, including additional testing and inspections and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby.

§ 12.2.2 If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of one year shall be extended with respect to portions of Work first performed after Substantial

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Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation under this Section 12.2.2 shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

§ 12.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 2.4. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Architect issued through the Construction Manager, the Owner may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice, the Owner may upon ten additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

§ 12.2.5 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or other Contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

§ 12.2.6 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the time period of one year as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

§ 12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

§ 13.1.1 The Contract shall be governed by the law of the place where the Project is located.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.3 WRITTEN NOTICE

§ 13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

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§ 13.4.2 No action or failure to act by the Owner, Construction Manager, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so the Construction Manager and Architect may observe such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

§ 13.5.2 If the Construction Manager, Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Construction Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so the Construction Manager and Architect may observe such procedures. The Owner shall bear such costs except as provided in Section 13.5.3.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Construction Manager for transmittal to the Architect.

§ 13.5.5 If the Construction Manager or Architect is to observe tests, inspections or approvals required by the Contract Documents, the Construction Manager or Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

§ 13.6.1 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

§ 13.7.1 As between the Owner and Contractor:

.1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

.2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and

.3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to

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run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contract may terminate the Contract if the Work is stopped for a period of 30 days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor, for any of the following reasons:

.1 issuance of an order of a court or other public authority having jurisdiction;

.2 an act of government, such as a declaration of national emergency, making material unavailable;

.3 because the Construction Manager or Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.2, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents;

.4 if repeated suspensions, delays or interruptions by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less; or

.5 the Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 If one of the above reasons exists, the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages.

§ 14.1.3 If the Work is stopped for a period of 60 days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.2.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor:

.1 persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, after consultation with the Construction Manager, and upon certification by the Architect that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 accept assignment of subcontracts pursuant to Section 5.4; and

.3 finish the Work by whatever reasonable method the Owner may deem expedient.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

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§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Architect after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 An adjustment shall be made for increases in the cost of performance of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. No adjustment shall be made to the extent:

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of this Contract.

§ 14.3.3 Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.

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SECTION 007300 - SUPPLEMENTARY CONDITIONS

1. GENERAL CONDITIONS

1.1. The General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, AIA Document A201/CMa - 1992 Edition, Articles 1 through 14 inclusive, is a part of this contract and is bound herewith.

1.2 References to Articles herein are to Articles in A201/CMa – 1992 Edition.

2. SUPPLEMENTARY CONDITIONS

2.1. The following provisions modify, change, delete from or add to AIA Document A201/CMa - 1992 Edition. Where any article of the General Conditions is modified or any paragraph, subparagraph or clause thereof is modified or deleted by these provisions, the unaltered provisions of that article, paragraph, sub-paragraph or clause shall remain in effect.

3. REFERENCE TO DIVISION 1 - GENERAL REQUIREMENTS

3.1 Certain provisions of Division 1 GENERAL REQUIREMENTS supplement the administrative and work-related provisions of the GENERAL CONDITIONS.

3.2 Articles affected are cross referenced in the various Sections of Division 1.

3.3 ARTICLE 1 - GENERAL PROVISIONS

A. Paragraph 1.1 - Basic Definitions

Add the following paragraph 1.1.1:

"The Contract Documents also include Advertisement for Bid, Instructions to Bidder, sample forms, the Bid Form, the Contractor's completed Bid and the Award Letter."

Add the following subparagraph:

1.1.8 Terms and Definitions

The following definitions apply to the terms listed below as used on the Drawings and in the Project Manual:

Provide: Furnish and Install

Approved: Approved by Architect or authority enforcing standards

Described: Refer to Project Manual

Specified: Refer to Project Manual

Shown: Refer to Drawings

Add the following subparagraph:

1.3.2 The Contractor will be furnished free of charge up to five (5) sets of the Drawings and Project Manual. Additional sets will be furnished at the cost of reproduction, postage, and handling.

3.4 ARTICLE 2 – OWNER

A. To Subparagraph 2.2.3 – Add the following sentence:

"The Contractor, at their expense shall bear the costs to accurately identify the location of all underground utilities in the area of their excavation and shall bear all costs for any repairs required, out of failure to accurately identify said utilities."

B. Delete Subparagraph 2.2.5 in its entirety and substitute the following:

2.2.5 The Contractor shall be furnished free of charge up to two (2) sets of the Drawings and Project Manuals. As well as an electronic version for their use.

3.5 ARTICLE 3 – CONTRACTOR

A. Paragraph 3.1 - Definition

Sub-paragraph 3.1.1: Add the following sentences:

"This definition applies to each Contractor having an agreement with the Owner."

"The duties and obligations of the Contract apply to this Contractor (as defined herein) regardless of similar or identical duties or obligations of other Prime Contracts related to the Project. Therefore, even though other Prime Contractors may have similar, identical or overlapping duties and obligations, each and every duty and obligation set forth in this Contract is enforceable against this Contractor."

B. Amend Paragraph 3.2.2 to state the any errors, inconsistencies or omissions discovered shall be reported to the Architect and Owner immediately.

C. Delete the third sentence in Paragraph 3.2.3.

D. Add the following Paragraphs:

3.3.2.1 The Contractor shall immediately remove from the Work, whenever requested to do so by the Owner, any person who is considered by the Owner or Architect to be incompetent or disposed to be so disorderly, or who for any reason is not satisfactory to the Owner, and that person shall not again be employed on the Work without the consent of the Owner or Architect.

E. Paragraph 3.4 - Labor and Materials:

Add the following Paragraphs:

3.4.3 The Contractor must provide suitable storage facilities at the Site for the proper protection and safe storage of their materials. Consult the Owner and the Architect before storing any materials.

3.4.4 When any room is used as a shop, storeroom, office, etc., by the Contractor or Subcontractor(s) during the construction of the Work, the Contractor making use of these areas will be held responsible for any repairs, patching or cleaning arising from such use.

3.4.5 Refer to Division 1 for detailed requirements concerning Temporary Facilities and Equipment.

3.4.6 Before starting the Work, each Contractor shall carefully examine all preparatory Work that has been executed to receive their Work. Check carefully, by whatever means are required, to insure that its Work and adjacent, related Work, will finish to proper contours, planes and levels. Promptly notify the General Contractor/Construction Manger of any defects or imperfections in preparatory Work which will in any way affect satisfactory completion of its Work. Absence of such notification will be construed as an acceptance of preparatory Work and later claims of defects or requests for adjustment of the Contract Sum will be denied.

3.4.7 Under no circumstances shall the Contractor's Work proceed prior to preparatory Work having been completely cured, dried and/or otherwise made satisfactory to receive this Work. Responsibility for timely installation of all materials

rests solely with the Contractor responsible for the Work, who shall maintain coordination at all times.

F. Paragraph 3.5 - Warranty:

Add the following Paragraphs:

3.5.2 The Contractor will guarantee all materials and workmanship against original defects, except injury from proper and usual wear when used for the purpose intended, for one year after Acceptance by the Owner, and will maintain all items in perfect condition during the period of guarantee.

3.5.3 Defects appearing during the period of guarantee will be made good by the Contractor, at his sole expense, upon demand of the Owner, it being required that all work will be in perfect condition when the period of guarantee will have elapsed.

3.5.4 In addition to the General Guarantee there are other guarantees required for certain items for different periods of time than the one year above, and are particularly so stated in the part of the specifications referring to same. The said guarantees will commence at the same time as the General Guarantee.

3.5.5 If the Contractor fails to remedy any failure, defect or damage within a reasonable time after receipt of notice, the Owner will have the right to replace, repair or otherwise remedy the failure, defect or damage at the Contractor's expense.

G. Paragraph 3.7 - Permits, Fees and Notices

Add the following subparagraphs:

3.7.5 Where the local law at the site of the building requires a Certificate of Occupancy, the Construction Manager shall obtain and pay for this Certificate through the Owner and deliver it to the Owner.

3.7.6 The general building permit for all components of the entire project will be obtained from the applicable authority and paid for by the Owner through the Construction Manager.

H. Paragraph 3.12 - Shop Drawings, Product Data and Samples

Add the following subparagraph:

3.12.12 Refer to Section 013300, SUBMITTALS, for detailed requirements.

I. 3.15 - Cleaning Up

Add the following subparagraph:

3.15.3 Refer to Section 011100, SUMMARY OF WORK, for detailed requirements.

3.6 ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

A. Paragraph 4.1 - Architect

Add the following Subparagraph:

4.1.2 The Architect will have no full-time project representative on this project.

Delete Paragraph 4.5 in its entirety and replace with the following:

4.5 The Architect will approve or reject Claims by Written decision, which shall state the reasons therefore and shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be subject to mediation and other remedies at law as herein set forth.

3.7 ARTICLE 5 - SUBCONTRACTORS

A. Paragraph 5.2 - Awards of Subcontracts and Other Contracts for Portions of the Work.

Delete subparagraph 5.2.3 in its entirety and replace with the following:

5.2.3 If the Owner or Construction Manager has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Construction Manager has no reasonable objection, subject to the statutory requirements of 29 Delaware Code 6962(d)(10)b.3,4.

Add the following subparagraph:

5.2.5 Delaware State law provisions concerning naming and use of Subcontractors supersede any foregoing provisions of

Paragraph 5.2 where such provisions are in conflict with Delaware State Law. Refer to provisions in Section 002113 INSTRUCTIONS TO BIDDERS.

3.8 ARTICLE 6 - CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS

A. Paragraph 6.1 - Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

Add the following subparagraph:

6.1.4 Refer to Section 011100, SUMMARY OF WORK, for detailed requirements.

B. Paragraph 6.2 - Mutual Responsibility

Delete Subparagraph 6.2.5 in its entirety and substitute the following:

6.2.5 Should the Contractor, any Subcontractor, or Sub-subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts any of them may be liable, cause damage to the work of property of any separate Contractor on the project, or should such separate Contractor or interested party sustain loss or damaged due to acts or omissions on the part of the Contractor any Subcontractor or Sub-subcontractor, any one directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the Contractor shall, upon due notice settle with such other Contractors by agreement or arbitration, if he will so settle. Contractor shall use all reasonable means to resolve the matter quickly. If such separate Contractor sues the Owner, Construction Manager, or Architect, or initiates an arbitration proceeding on account of any damages alleged to have been so sustained, the Owner, Construction Manager, or Architect shall notify the Contractor, who shall indemnify them and defend such proceedings at the Owner, Construction Manager, or Architect's expense. If any judgment against the Owner, Construction Manager, or Architect arises therefrom, the Contractor shall pay or satisfy it, together with all fees, costs, expenses, disbursements, or liabilities related thereto. The Contractor shall also reimburse the Owner, Construction Manager, or Architect for all attorney's fees and court or arbitration costs which the Owner, Construction Manager, or Architect has incurred.

3.9 ARTICLE 7 - CHANGES IN THE WORK

A. Paragraph 7.2 - Change Orders

Add the following subparagraphs:

7.2.3 See Section 012600, CHANGE ORDER PROCEDURES, for detailed requirements.

7.2.4 In the event that work is performed under the provisions of paragraph 7.33, the Owner will reimburse the Contractor for all costs directly incurred in the performance of the Work, plus overhead and profit as follows: Costs shall include the cost of materials including sales tax and cost of delivery; cost of labor, including social security, old age and unemployment insurance, and fringe benefits required by agreement or custom; bond premiums, rental value of power tools, equipment and machinery. Overhead shall include the following: supervision, superintendent, wages of time keepers, watchmen and clerks, hand tools, incidentals, general office expense, and all other expenses not included in "cost". All such overhead shall be directly attributable to the change. As applied to Change Orders, overhead and profit shall be as follows:

1. For extra work performed by the Contractor with his own forces, 10% for overhead and 5% for profit.

2. For work done by a subcontractor, 10% for overhead and 5% for profit to which the Contractor may add an additional 7.5% for his overhead and profit combined.

3. For work deleted by a Change Order or where reductions in costs are involved, no item for overhead or profit shall be included in the computation. Change Orders shall have additions and deductions figured separately without overhead and profit added. The smaller amount shall then be deducted from the larger to determine the net value of the change. If the net results in an addition to the Contract Sum, the above overhead and profit items shall be added to the net increase only.

3.10 ARTICLE 8 - TIME

A. Paragraph 8.2 - Progress and Completion

Delete subparagraph 8.2.3 in its entirety and substitute the following:

8.2.3 Refer to Section 011100 SUMMARY OF WORK and Section 013216, SCHEDULING, for detailed requirements. Work

shall commence immediately upon the Contractors receipt of a letter of intent from the Construction Manager.

8.2.4 The Contractor guarantees and warrants that there will be sufficient tradesmen on the job each day to ensure that there will be no interruption of work. If the Construction Manager in his sole discretion decides that the work and the progress of the job has been impeded because of the Contractor's inability to supply tradesmen for the job, the Construction Manager may terminate the contract with forty-eight (48) hours notice.

8.2.5 If the Work falls behind Progress Schedule as submitted by the Contractor, the Contractor shall employ additional labor and/or equipment necessary to bring the Work into compliance with the Progress Schedule at no additional cost to the Owner.

B. Paragraph 8.3 – Delays and Extensions of Time

Add the following subparagraph:

8.3.2.1 The Contractor shall update the status of the suspension, delay or interruption of the Work with each Application for Payment. (The Contractor shall report the termination of such cause immediately upon the termination thereof.) Failure to comply with this procedure shall constitute a waiver for any claim for adjustment of time or price based upon said cause.

Delete Paragraph 8.3.3 in its entirety and replace with the following:

8.3.3 Except in the case of a suspension of the Work directed by the Owner, an extension of time under the provisions of Paragraph 8.3.1 shall be the Contractor's sole remedy in the progress of the Work and there shall be no payment or compensation to the Contractor for any expense or damage resulting from the delay.

Add the following Paragraph:

8.3.4 By permitting the Contractor to work after the expired time for completion of the project, the Owner does not waive its rights under the Contract.

3.11 ARTICLE 9 - PAYMENTS AND COMPLETION

A. Paragraph 9.2 - Schedule of Values

Add the following sentence to subparagraph 9.2.1:

"Refer to Section 013300, SUBMITTALS, for submittal requirements."

Add the following subparagraphs:

9.2.2 The Schedule of Values shall be submitted using AIA Document G702, Continuation Sheet to G703.

9.2.3 The Schedule of Values is to include a line item for Project Closeout Document Submittal. The value of this item is to be no less than 3.5% of the initial contract amount.

B. Paragraph 9.3 - Applications for Payment

Add the following Subparagraphs:

9.3.4 Until Closeout Documents have been received and outstanding items completed, the Owner will pay 95% (ninety-five percent) of the amount due the Contractor on account of progress payments.

C. Paragraph 9.5 – Decisions to Withhold Certification

Add the following to 9.5.1:

failure to provide a current Progress Schedule;
a lien or attachment is filed;
failure to comply with mandatory requirements for maintaining Record Documents.

D. Paragraph 9.6 - Progress Payments

Delete subparagraph 9.6.1 in its entirety and replace with the following:

9.6.1 After the Architect has approved and issued a Certificate for Payment, payment shall be made by the Owner within 30 days after Owner's receipt of the Certificate of Payment.

3.12 Article 10 – Protection of Persons and Property

A. 10.1 SAFETY PRECAUTIONS AND PROGRAMS

Add the following Paragraphs:

10.1.2 Contractor shall develop a safety program in accordance with the Occupational Safety and Health Act of 1970. A copy of said plan shall be furnished to the Owner and Architect prior to the commencement of that Contractor's Work.

10.1.3 Contractor shall appoint a Safety Representative. Safety Representatives shall be someone who is on site on a full time bases. If deemed necessary by the Owner or Architect, Contractor Safety meetings will be scheduled. The attendance of all Safety Representatives will be required. Minutes will be recorded of said meeting by the Contractor and will be distributed to all parties as well as posted in all job offices/trailers etc.

3.13 ARTICLE 11 - INSURANCE

A. Paragraph 11.1.: Contractor's Liability Insurance

Subparagraph 11.1.1: Make the following change:

11.1.1 In the first line following the word "maintain" insert the words "in a company or companies licensed to do business in the state of Delaware....".

B. Subparagraph 11.1.2: Delete entirely and insert the following:

11.1.2 "The insurance required by subparagraph 11.1.1 shall be written for not less than the following or as required by law, whichever is greater.

In conjunction with Insurance Requirements AIA General Conditions, Article 11, the Contractor shall be bound by the following limits of liability insurance (for contracts under this bid pac). The Contractor shall use the standard "ACCORD" form titled "Certificate of Insurance" in submitting his liability insurance limits. The required limits to be inserted in the "ACCORD" form are as follows:

The Contractor shall purchase and maintain at all times throughout the term of this Agreement without interruption and, at the least, from the date of the commencement of the Work until the date of final payment or the date insurance coverage is required to be maintained after final payment to the Contractor under this Agreement, whichever is later, the following insurance coverages (with the specified limits of liability) and shall provide to the Construction Manager the complete policies for such insurance coverages upon the request of the Construction Manager:

11.1.2.1 Commercial General Liability ("CGL") coverage with limits of not less than $1,000,000 each occurrence and $2,000,000 in the "annual aggregate".

11.1.2.1.1 If the CGL coverage contains a "General Aggregate Limit", such General Aggregate Limit shall apply separately to each project of the Contractor, specifically including this Project.

11.1.2.1.2 CGL coverage shall be written on ISO Occurrence Form CG 00 011093, or a substitute form providing equivalent coverage and shall cover liability arising from premises, operations, independent contractors, product-completed operations and personal and advertising injury.

11.1.2.1.3 EDiS Company, Owner and all other parties required by EDiS Company shall be included as additional insureds on the CGL using Additional Insured Endorsements that provide coverage for both ongoing and completed operations. The insurance for the additional insureds shall be as broad as the coverage provided for the named insured Contractor. The CGL coverage shall apply as Primary and non-contributory insurance before any other insurance or self-insurance, including any deductible, maintained by, or provided to, any additional insured other than the other insurances coverages purchased and maintained by the Contractor hereunder.

11.1.2.1.4 Contractor shall maintain CGL coverage for itself and all additional insureds for the duration of the Project and maintain Completed Operations coverage for itself and each additional insured for at least three (3) years after completion of the Work, using Additional Insured Endorsements that provide Completed Operations Coverage.

11.1.2.2. Business Automobile Liability ("BAL") coverage with combined single limits of at least $1,000,000 (per occurrence).

11.1.2.2.1 BAL coverage must include coverage for liability arising out of all owned, leased, hired and non-owned automobiles.

11.1.2.2.2 BAL coverage shall be written on an occurrence basis.

11.1.2.2.3 Construction Manager, Owner and all other parties required by the Construction Manager shall be included as additional insureds on the BAL coverage. The insurance for the additional insureds shall be as broad as the coverage provided for the named insured Contractor. The BAL coverage shall apply as Primary and non-contributory insurance before any other insurance or self-insurance, including any deductible, maintained by, or provided to, any additional insured other than the other insurances coverages purchased and maintained by the Contractor hereunder.

11.1.2.3. Commercial Umbrella ("CU") coverage with limits of at least $5,000,000.

11.1.2.3.1 CU coverage shall be written on an occurrence basis.

11.1.2.3.2 Construction Manager, Owner and all other parties required by the Construction Manager shall be included as additional insureds on the CU coverage for both ongoing and Completed Operations. The insurance for the additional insureds shall be as broad as the coverage provided for the named insured Contractor. The CU coverage shall apply as Primary and non-contributory insurance before any other insurance or self-insurance, including any deductible, maintained by, or provided to, any additional insured other than the other insurances coverages purchased and maintained by the Contractor hereunder.

11.1.2.4 Workers' Compensation shall be maintained to protect against claims under the workers' compensation act with limits of at least $500,000 for each accident. Employers'

Liability coverage will also be maintained with limits of at least $500,000 for each accident for bodily injury including death and disease.

11.1.2.4.1 WCEL coverage shall be written on an occurrence basis.

11.1.2.4.2 Where applicable and/or as required by the construction manager, the U.S. Longshoremen and Harborworkers' Compensation Act endorsement shall be included as part of the WCEL coverage and attached to the policy for WCEL coverage.

11.1.2.4.3 Where applicable and/or as required by the Construction Manager, the Maritime Coverage Endorsement shall be included as part of the WCEL coverage and attached to the policy for WCEL coverage.

11.1.2.5 The Contractor shall provide property insurance necessary for the protection against loss of owned, rented or borrowed capital equipment and tools, including tools owned by employees, and any tools, equipment staging towers and forms owned, rented or borrowed by the Subcontractor. The property insurance shall include a Waiver of Subrogation in favor of all parties required to be named as Additional Insureds under the Contract Documents. Contractor shall ensure that any subcontractor employed by him similarly carries sufficient insurance to protect that subcontractor's property.

11.1.2.6 Contractor waives all rights against the Construction Manager, Owner and all their agents, officers, directors and employees for recovery of damages to the extent those damages are covered by any of the insurance coverages purchased and maintained by the Contractor.

11.1.2.7 Contractor shall provide the Construction Manager with appropriate certificates of insurance coverages evidencing that the insurance coverages required herein are valid and in full force and effect at least thirty (30) days before the Contractor performs any Work and before the Contractor or any of its agents, subcontractors or employees enters upon the job site. Each such certificate of insurance and the actual insurance policy for each insurance coverage required herein shall contain a provision that the coverage and protection afforded under the policy will not be canceled or

modified or allowed to expire without at least thirty (30) days' prior written notice to the Construction Manager.

11.1.2.8 Each policy of insurance coverage purchased and maintained by the Contractor herein shall be so purchased and maintained from or by an insurance company properly and fully authorized and licensed to do business and to issue policies of insurance in the state in which the Project is located.

11.1.2.9 Each policy of insurance coverage purchased and maintained by the Contractor herein shall provide that the insurer shall defend any suit or action against the Construction Manager, Owner and/or their agents, officers, directors and employees and hold them harmless, even if such suit or action is frivolous or fraudulent. Such policy also shall provide the Construction Manager and Owner the right to engage their/its own attorney(s) for the purpose of defending any legal action against the Construction Manager, Owner and their agents, officers, directors and employees, and that the Contractor shall indemnify and hold harmless the Construction Manager, Owner, and their agents, officers, directors and employees, for costs and expenses, including attorney's fees, arising out of or incurred in defending such suit or action.

11.1.2.10 The purchase, maintenance or issuance of insurance coverage of any type by the Contractor or the Construction Manager or Owner as required herein or otherwise, shall not be deemed or construed to release, limit, waive or discharge the Contractor from any or all of the obligations and risks imposed by the Agreement upon the Contractor. Neither shall any forbearance nor omission by the Construction Manager to require proof of insurance coverages or certificates of insurance or to obtain or review any policies of insurance coverage from the Contractor before permitting the Contractor to proceed or continue with the Work be deemed a waiver of the Construction Manager's rights or the Contractor's obligations regarding the provision of insurance coverage under this Agreement.

11.1.2.11 Waiver of Subrogation. Subcontractor hereby waives any and all rights of recovery against the Construction Manager, Owner and their respective officers, members, agents, employees, and insurance companies occurring on or arising out of Contractor's Work to the extent such loss or damage is covered by proceeds received from insurance required under this Agreement to be carried by the Contractor.

11.1.2.12 Contractor hereby certifies that it has furnished to its insurance provider(s) a copy or copies of the foregoing insurance requirements (all the applicable requirements of Section 9. hereof) ("requirements"), and Contractor, for and on behalf of itself and its insurance provider(s), certifies and agrees that all insurance coverages (including but not limited to the types, limits, periods of coverage, endorsements and policies applicable or in regard thereto) provided to the Construction Manager hereunder are in accordance and full compliance with the requirements, as reasonably determined and interpreted by the Construction Manager. Contractor, to the fullest extent permitted by applicable law, shall defend, indemnify and save harmless the Construction Manager, Owner and their respective successors, assigns, directors, officers, agents and employees from and against any and all damages and losses, without limitation, including attorneys' fees and costs caused by, arising out of or resulting from the Contractor or its insurance provider(s) refusal or failure to provide all the insurance coverages (including but not limited to the types, limits, periods of coverage, endorsements and policies applicable or in regard thereto) required hereunder, to comply in any respect with the requirements, and/or to fully honor and abide by any of the certifications and/or agreements set forth in this section.

3.14 ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.2 Correction of Work

Add the following Subparagraph to 12.2.2:

12.2.2.1 At any time during the progress of the Work, or in any case where the nature of the defects will be such that it is not expedient to have the defects corrected, the Owner, at its option, will have the right to deduct such sum, or sums, of money from the amount of the Contract as it considers justified to adjust the difference in value between the defective work and that required under contract including any damage to the structure.

3.15 ARTICLE 13: MISCELLANEOUS PROVISIONS

Add the following Paragraph:

13.8 CONFLICTS WITH FEDERAL STATUTES OR REGULATIONS

13.8.1 If any provision, specifications or requirement of the Contract Documents conflict or is inconsistent with any statute, law or regulation of the government of the United States of America, the Contract shall notify the Architect and Owner immediately upon discovery.

3.16 ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT

14.3 TERMINATION BY THE OWNER FOR CONVENIENCE

Delete Paragraph 14.3.3 in its entirety and replace with the following:

14.3.3 In case of such termination for the Owner's convenience the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination along with reasonable overhead.

Add the following Articles and Paragraphs:

3.17 ARTICLE 15 - PREFERENCE FOR DELAWARE LABOR (NEW ARTICLE)

A. 15.1 The Contractor shall comply with the following provisions of Delaware Code, Title 29, Chapter 69, Section 6910:

In the construction of all public works for the State or any political subdivision or by persons contracting with the State or any political subdivision thereof, preference in employment of laborers, workmen or mechanics, shall be given to bona fide legal citizens of the State who have established citizenship by residence of at least 90 days in the State. Each public works contract for the construction of public works for the State or any political subdivision thereof shall contain a stipulation that any person, company, or corporation who violates this section shall pay a penalty to the Secretary of Finance equal to the amount of compensation paid to any person in violation of this section.

3.18 ARTICLE 16 - LICENSE AND TAX REQUIREMENTS (NEW ARTICLE)

A. 16.1 Contractor and subcontractor shall be licensed to do business in the State of Delaware and shall pay all fees and taxes due under State laws. Contractor's shall submit a copy of all business licenses required by local and state agencies. In conformance with Section 2503, Chapter 25, Title 30, Delaware Code, the Contractor shall furnish the State Tax Department, within 10 days after award of contract, a statement of the total values of each contract and subcontract,

together with the names and addresses of the contracting parties. The Contractor, before the payment of any award or amount payable to any Contractor or subcontractor not a resident of Delaware, shall ascertain from said non-resident Contractor or subcontractor and/or the State Tax Department, whether he has obtained a license and satisfied his liability paid by the non-resident Contractor or subcontractor, the Contractor shall deduct form the award the amount payable to said non-resident contractor or subcontractor the amount of said license liability and shall pay same to the State Tax Department within 10 days after final payment and settlement with the non-resident Contractor or subcontractor.

B. 16.2 Taxes: The Contractor shall pay all sales, consumer, use and other taxes required by law.

3.19 ARTICLE 17 - PREVAILING DELAWARE WAGE RATES (NEW ARTICLE)

A. 17.1 In accordance with Delaware Code, Title 29, Chapter 69, Section 6960, all laborers and mechanics of the Contractor and all subcontractors employed to perform work directly upon the site of the work shall be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account the full amounts accrued at the time of payment computed at wage rates not less than those determined by the Division of Industrial Affairs, Department of Labor, State of Delaware, as the prevailing rates in this area.

B. 17.2 This approved scale of wages must be posted by the Contractor in a prominent and easily accessible place at the site of the work.

C. 17.3 It is further stipulated that there may be withheld from the Contractor such accrued payment as may be considered necessary by the contracting officer to pay laborers and mechanics employed by the Contractor or any subcontractors on the work the difference between the rates of wages required and the rate of wages received by such laborers and mechanics and not refunded to the Contractor, Subcontractor or their agents.

D. 17.4 Where wage rates are published in this Manual they are issued by the State Department of Labor on the date indicated and are included for the convenience of Bidders. The Owner, the Architect, and the Construction Manager, accept no responsibility for the accuracy or applicability of any rates included herein. The actual wage rate determinations which

will apply to the work will be those in effect on the first day of public advertisement for bids as determined by the State Department of Labor. It will be the responsibility of each bidder to contact the State Department of Labor and to incorporate these rates in his bid.

E. 17.5 "In accordance with Delaware Code, Title 29, Section 6960 as amended January 24, 2008, contractors shall furnish sworn payroll information to the Department of Labor on a weekly basis for each contract which exceeds $15,000 for renovation work and $100,000 for new construction. The construction contract amount is based on a cumulative total of all contracts bid for a specific project. Payroll forms for submission may be obtained from the Department of Labor."

17.5.1 A Payroll Report, available from the Department of Labor is to be used to provide this information.

END OF SECTION

SECTION 007343 – WAGE RATE REQUIREMENTS

1. SUMMARY

1.1. In accordance with Delaware Code, Title 29, Chapter 69, Section 6912, all laborers and mechanics of the Contractor and all subcontractors employed to perform work directly upon the site of the work shall be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account the full amounts accrued at the time of payment computed at wage rates not less than those determined by the Division of Industrial Affairs, Department of Labor, State of Delaware, as the prevailing rates in this area.

1.2 This approved scale of wages must be posted by the Contractor in a prominent and easily accessible place at the site of the work.

1.3 It is further stipulated that there may be withheld from the Contractor such accrued payment as may be considered necessary by the contracting officer to pay laborers and mechanics employed by the Contractor or any subcontractors on the work the difference between the rates of wages required and the rate of wages received by such laborers and mechanics and not refunded to the Contractor, subcontractor or their agents.

1.4 Where wage rates are published in this Manual they are issued by the State Department of Labor on the date indicated and are included for the convenience of Bidders. The Owner, the Architect, and the Construction Manager, accept no responsibility for the accuracy or applicability of any rates included herein. The actual wage rate determinations which will apply to the work will be those in effect on the first day of public advertisement for bids as determined by the State Department of Labor. It will be the responsibility of each bidder to contact the State Department of Labor and to incorporate these rates in his bid.

1.5 "In accordance with Delaware Code, Title 29, Section 6912, as amended July 5, 1994, contractors shall furnish sworn payroll information to the Department of Labor on a weekly basis for each contract which exceeds $15,000 for renovation work and $100,000 for new construction. The construction contract amount is based on a cumulative total of all contracts bid for a specific project. Payroll forms for submission may be obtained from the Department of Labor."

1.5.1 A Payroll Report, available from the Department of Labor is to be used to provide this information.

1.6 A copy of the Prevailing Wages for the project is attached hereto.

END OF SECTION

STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
OFFICE OF LABOR LAW ENFORCEMENT
PHONE: (302) 451-3423

Mailing Address:
225 CORPORATE BOULEVARD
SUITE 104
NEWARK, DE 19702

Located at:
225 CORPORATE BOULEVARD
SUITE 104
NEWARK, DE 19702

PREVAILING WAGES FOR **BUILDING CONSTRUCTION** EFFECTIVE MARCH 15, 2012

CLASSIFICATION	NEW CASTLE	KENT	SUSSEX
ASBESTOS WORKERS	23.22	29.83	39.20
BOILERMAKERS	65.47	33.22	48.83
BRICKLAYERS	45.63	45.63	45.63
CARPENTERS	49.06	49.06	39.22
CEMENT FINISHERS	40.38	29.11	21.20
ELECTRICAL LINE WORKERS	43.49	37.29	28.44
ELECTRICIANS	59.10	59.10	59.10
ELEVATOR CONSTRUCTORS	73.14	40.93	30.55
GLAZIERS	62.60	62.60	54.20
INSULATORS	50.38	50.38	50.38
IRON WORKERS	58.70	58.70	58.70
LABORERS	37.20	37.20	37.20
MILLWRIGHTS	60.85	60.85	47.42
PAINTERS	40.62	40.62	40.62
PILEDRIVERS	66.42	37.64	30.45
PLASTERERS	21.61	21.61	17.50
PLUMBERS/PIPEFITTERS/STEAMFITTERS	57.95	43.24	46.28
POWER EQUIPMENT OPERATORS	55.81	55.81	24.13
ROOFERS-COMPOSITION	21.01	20.71	17.02
ROOFERS-SHINGLE/SLATE/TILE	17.59	17.50	16.45
SHEET METAL WORKERS	64.39	62.18	62.18
SOFT FLOOR LAYERS	44.92	44.92	44.92
SPRINKLER FITTERS	50.65	50.65	50.65
TERRAZZO/MARBLE/TILE FNRS	50.50	50.50	45.45
TERRAZZO/MARBLE/TILE STRS	57.98	57.98	52.63
TRUCK DRIVERS	22.49	23.89	20.03

CERTIFIED:_____ BY:_____
ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

NOTE: THESE RATES ARE PROMULGATED AND ENFORCED PURSUANT TO THE PREVAILING WAGE REGULATIONS ADOPTED BY THE DEPARTMENT OF LABOR ON APRIL 3, 1992.

CLASSIFICATIONS OF WORKERS ARE DETERMINED BY THE DEPARTMENT OF LABOR. FOR ASSISTANCE IN CLASSIFYING WORKERS, OR FOR A COPY OF THE REGULATIONS OR CLASSIFICATIONS, PHONE (302) 451-3423.

NON-REGISTERED APPRENTICES MUST BE PAID THE MECHANIC'S RATE.

THESE RATES ARE BEING PROVIDED IN ACCORDANCE WITH DELAWARE'S FREEDOM OF INFORMATION ACT.

THEY ARE NOT INTENTED TO APPLY TO ANY SPECIFIC PROJECT.

SECTION 10 11 00 - SUMMARY OF WORK

1. RELATED DOCUMENTS

1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Sections, apply to work of this Section.

2. CONTRACTS

2.1 The work will be performed under separate prime contracts managed by the Construction Manager.

3. ALTERATIONS & COORDINATION

3.1 Contractor shall be responsible to coordinate their work with the work of others, including, but not limited to, the preparation of general coordination drawings, diagrams and schedules, and control of site utilization, from the beginning of activity, through project close-out and warranty periods.

4. KNOWLEDGE OF CONTRACT REQUIREMENTS

4.1 The Contractor and his Subcontractors, Sub-subcontractors and material men shall consult in detail the Contract Documents for instructions and requirements pertaining to the Work, and at his and their cost, shall provide all labor, materials, equipment and services necessary to furnish, install and complete the work in strict conformance with all provisions thereof.

4.2 The Contractor will be held to have examined the site of the Work prior to submitting his proposal and informed himself, his Subcontractors, Sub-subcontractors and material men of all existing conditions affecting the execution of the Work.

4.3 The Contractor will be held to have examined the Contract Documents and modifications thereto, as they may affect subdivisions of the Work and informed himself, his Subcontractors, Sub-subcontractors and material men of all conditions thereof affecting the execution of the Work.

4.4 The Scope of Work for the Contract is not necessarily limited to the description of each section of the Specifications and the illustrations shown on the Drawings. Include all minor items not expressly indicated in the Contract Documents, or as might be found necessary as a result of field conditions, in order to complete the Work as it is intended, without any gaps between the various subdivisions of work.

4.5 The Contractor will be held to be thoroughly familiar with all conditions affecting labor in the area of the Project including, but not limited to, Unions, incentive pay, procurements, living, parking and commuting conditions and to have informed his Subcontractors and

Sub-subcontractors thereof.

5. CONTRACT DOCUMENTS INFORMATION

5.1 The Contract Documents are prepared in accordance with available information as to existing conditions and locations. If, during construction, conditions are revealed at variance with the Contract Documents, notify the Construction Manager immediately, but no more than three (3) days from the day the variance is first known. Failure to give timely notice shall operate to waive any claim Contractor might otherwise have for an adjustment to Contract Time or Sum as a consequence of such variance.

5.2 The Specifications determine the kinds and methods of installation of the various materials, the Drawings establish the quantities, dimensions and details of materials, the schedules on the Drawings give the location, type and extent of the materials.

5.3 Dimensions given on the Drawings govern scale measurements and large scale drawings govern small scale drawings, except as to anything omitted unless such omission is expressly noted on the large scale drawings.

5.4 The techniques or methods of specifying to record requirements varies throughout text, and may include "prescriptive", "open generic/descriptive", "compliance with standards", "performance", "proprietary", or a combination of these. The methods used for specifying one unit of work has no bearing on requirements for another unit of work.

5.5 Whenever a material, article or piece of equipment is referred to in the singular number in the Contract Documents, it shall be the same as referring to it in the plural. As many such materials, articles or pieces of equipment shall be provided as are required to complete the Work.

5.6 Whenever a material, article or piece of equipment is specified by reference to a governmental, trade association of similar standard, it shall comply with the requirements of the latest publication thereof and amendments thereto in effect on the bid date.

5.7 In addition to the requirements of the Contract Documents, Contractor's work shall also comply with applicable standards of the construction industry and those industry standards are made a part of Contract Documents by reference, as if copied directly into Contract Documents, or as if published copies were bound herein.

5.8 Where compliance with two (2) or more industry standards, contract requirements, or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, then the most stringent requirements, which are generally recognized to be also the most costly, is intended and will be enforced, unless specifically detailed language written into the Contract Documents clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently equal but different requirements, and uncertainties as to which level of quality

is more stringent, to Architect for decision before proceeding.

5.9 Reference standards referenced directly in Contract Documents or by governing regulations have precedence over non-reference standards which are recognized in industry for applicability of work.

5.10 Contractor's bid is based on the complete set of Contract Documents including documents not specifically issued as part of the bid pack but referenced in same.

6. SCOPE OF WORK/GENERAL INFORMATION

6.1 A Scope of Work for each contract to be awarded on the project follows in this section. When a Contract has been awarded to a Contractor, the successful Contractor will be listed after the title of the Contract. When no Contract has yet been awarded, no Contractor's name will be listed. Previous Scopes of Work include addendum changes.

6.2 Contractor is responsible for performing the work listed in the Summary of Work for his contract. Contractor is also responsible for knowing the work that has been assigned to preceding contracts. No additional compensation or extension of time will be allowed a Contractor due to his ignorance of the work assigned to his Contract or to other contracts which may affect his work. The Contractor is responsible, however, for all items which are covered in the Specifications and Drawings relating to their Contract if not specifically mentioned in the Summary of Work.

6.3 The Construction Manager will provide on site a source for temporary electric, temporary water and portable sanitation facilities only. It is each Contractor's responsibility to make the necessary connections, including all material for temporary electric and water. Please note that utility charges for office trailers will be the responsibility of the individual Contractors. As well as local permits required for trailers.

6.4 A dumpster will be provided on site for free use by Contractors to dispose of non-hazardous, common, work-related refuse. Clean-up is the responsibility of each Contractor. Clean up shall be performed on a daily basis. Contractors not complying will be advised in writing and back charged for all costs associated with the clean up of their work.

6.5 Contractors are reminded that there are limited storage areas available on site. Off site storage will be the responsibility of each individual Contractor.

6.6 Office trailer permits off site will be the responsibility of each individual Contractor. On site Contractor's field offices, one (1) per Contractor, if required, will be located as directed by the Construction Manager.

6.7 Contractor will be prepared to discuss and submit a detailed project schedule seven (7) days after receipt of Notice to Proceed and to begin its submittal process. The Project

Schedule is an integral part of this contract. Certain construction sequences and priorities must take place in order to meet the target dates. Concentrated work periods will occur and each Contractor is responsible to staff the project as required by the current Construction Schedule or as directed by the Construction Manager. Contractor will cooperate with the Construction Manager in planning and meeting the required sequences of work and Project Schedule as periodically updated by the Construction Manager.

6.8 All bids must include insurance limits in accordance with Article 11 of the Section 00 73 00 SUPPLEMENTARY CONDITIONS.

6.9 Hoisting, scaffolding and material handling is the responsibility of each Contractor, unless otherwise noted.

6.10 Contractor will be responsible for layout of its own work. The Construction Manager will provide benchmark and layout of the building line.

6.11 Contractor will be responsible to keep clean public roadways soiled by construction traffic on a daily basis. If cleaning is not done, the Construction Manager may perform the cleaning on an overtime basis and backcharge the Contractor responsible.

6.12 Contractor Scopes of Work and Schedule are interrelated. Familiarity with each is required.

6.13 The Construction Manager will provide testing services for soil, concrete and steel. Other testing as required by the Contract Documents will be in accordance with the technical specifications and/or the individual scope of work. Refer to Specification Section 01 45 00 - QUALITY CONTROL.

6.14 Safety is the responsibility of each individual Contractor. The project will be governed under the guidelines of OSHA.

6.15 Inter-Contractor shop drawing distribution will be performed by the Construction Manager. Contractor is individually responsible for either coordinating his work with these distributed drawings or notifying the Construction Manager, in writing, of any discrepancies.

6.16 Coordination with other trades will be required. The Contractor will be required to attend periodic coordination meetings with other trades where requirements, conflicts and coordination issues will be discussed and resolved. Attendance when requested will be mandatory. If inter-Contractor coordination is not satisfactorily performed, the conflicting Contractors shall mutually share the cost to relocate and/or reinstall their work.

6.17 Contractor shall submit a schedule of values to the Construction Manager through the

Building Blok Management Program prior to the submission of their first invoice for approval on AIA G702/CMa, Application for Payment and G703, Continuation Sheet.

6.18 Contractor is expected to review and coordinate its Work with the complete set of Contract Documents, including all items noted as by his trade whether or not shown on that particular set of drawings. Documents are available at the site for review.

6.19 Contractor is responsible for obtaining all necessary permits required for his work, including street permits. Unless otherwise noted, building permit shall be secured by the Construction Manager. Any subcontractor who will be restricting access to street, right of way or adjacent property must notify the Construction Manager 48 hours in advance.

The documents require the Subcontractor to secure their own permits. In some jurisdictions (Middletown, Newark, etc.) the permit (Mechanical, HVAC, etc.) is included in the Building Permit and you must specifically advise Subcontractor of the assessment and amount in order to avoid having them not be responsible.

6.20 Contractor's License: Submit a copy of all business licenses required by local and state agencies.

6.21 Contractor shall absorb, without additional compensation, any and all costs of working beyond normal hours to maintain job progress in accordance with the current construction schedule.

6.22 No asbestos or PCB's in or on any material or equipment will be accepted or allowed on this project. All hazardous materials will be treated in accordance with all State and Federal regulations.

6.23 Daily clean up of the work is the responsibility of each individual Contractor which includes broom cleaning of their debris as required. Contractor will be individually back charged by the Construction Manager for clean up not satisfactorily performed by the Contractor.

6.24 In the event asbestos is uncovered, the Contractor shall notify the Construction Manager of the areas requiring removal of asbestos. The Construction Manager shall then coordinate the removal with the Owner.

6.25 This project is to be constructed adjacent to and in existing buildings. Contractor shall exercise all due precautions to minimize noise, air pollution and any other construction hazards which in any way would cause discomfort or danger to the occupants of the existing building in the area.

6.26 Existing mechanical, electrical, plumbing, sprinkler, medical gas, fire alarm, etc. systems will be shut off and locked out by the Owner as required by the Work. Tie-in's and modifications to those systems will be performed by the specific Contractor associated

with the work as indicated in the Contract Documents. Re-energizing and re-start up of all systems should be performed by the Owner.

6.27 The Safety Cable System shall not be altered or removed without a written request submitted to the Project Manager with a copy to the Field Manager. It shall be the responsibility of each and every Contractor that is removing or altering the Safety Cable System to maintain the fall protection safety provided by the safety cable and not leave the area unprotected. Each and every Contractor shall be responsible to re-install the Safety Cable System immediately after work is completed. Each and every Contractor shall be responsible to re-install the Safety Cable System in accordance to OSHA standards.

6.28 Normal work hours for this project are from 7:00 a.m. to 3:30 p.m. Any work to be performed outside of these hours must receive prior approval from the Construction Manager. Requests to work beyond normal work hours shall be submitted at least 48 hours prior.

6.29 Contractor is responsible for having a competent project superintendent/foreman on-site during all work performed under its contract.

6.30 In the event the Contractor has non-English speaking employees or subcontractors on the project, they shall have a superintendent or foreman on site, at all times, who speaks English and can communicate with Contractor's employees. Should the Contractor fail to meet this requirement, at any time, Construction Manager may direct all Work to stop until the proper supervision is on site. The Contractor will be responsible for maintaining the project work schedule and make up at its own expense, any delay to the Schedule resulting from the work stoppage.

6.31 Punch List Procedures: Contractor shall be given a copy of the punch list with his appropriate work identified. Contractor shall have nine (9) calendar work days to complete its punch list work. On the 10th day or as determined by the Construction Manager, the Construction Manager shall employ other contractors, as required, to complete any incomplete punch list work and retain from the appropriate Contractors retainage all costs incurred.

6.32 Contractor shall provide the necessary safety barricades and railings required to complete their work and comply with all OSHA, local code and contract specifications.

CONTRACT NO. NDHS-33: SITE, FIELD STADIUMS AND ACCESSORIES

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Division 31	Earthwork
Division 32	Exterior Improvements
Section 01 74 19	Construction Waste Management and Disposal
Section 01 81 13	Sustainable Design Requirements LEED for Schools
Section 03 30 00	Cast-In-Place Concrete
Section 11 66 23	Track and Field Equipment
Section 11 68 20	Outdoor Athletic Equipment
Section 11 68 20	Stadium Padding
Section 12 93 00	Site Furnishings
Section 22 08 00	Common Work Results for Plumbing
Section 32 12 16	Asphalt Paving
Section 32 18 18	Tennis Court Pavement System
Section 32 84 00	Irrigation
Section 32 92 00	Meadow Planting
Section 32 92 23	Lawns
Section 32 93 00	Planting

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

- Provide sitework, utilities for work assigned with the contract.
- Furnish, install, maintain and remove sediment control system including sediment control plan. Maintain sediment control until substantial completion established by DNREC.
- Clearing and grubbing as necessary to accomplish work indicated on plans and specifications.
- Topsoil shall be stripped and stockpiled as necessary to accomplish your work.
- Rough grading for area defined on site drawings for buildings, lawn areas, bituminous pathways. Preparation of subgrade for building slabs.
- This Contractor is responsible for all excavation and backfill for work associated with this contract scope.
- Provide a certified construction reviewer (CCR) to perform inspections and provided written

reports; signed and sealed by professional engineer. Coordinate with DNREC.

- Provide all permits related to work for this project outside of building permit.
- Install complete all practice fields per base bid and alternates.
- Contractor to provide all permits; including City plumbing permit.
- Furnish, install and remove temporary orange construction fencing as required. To protect your work areas during construction.
- Proof rolling of limit of excavation.
- This contractor to provide all utility work as detailed on plans and specifications for Bid Package G, see documentation or plans.
- Backfilling as detailed below is the responsibility of this Contractor. Soil types shall be in accordance with DelDot standard specifications.
- It is the intent to use on site material and not imported fill. The use of this onsite material shall conform to the compaction requirements as specified on the civil drawings. If the on site material does not meet those requirements or if there is insufficient on site material available, this contractor shall import at no additional expense to the project sufficient material to complete the work.
- Provide perimeter protection of all excavated areas until suitably backfilled.
- Install "grass" auxillary stadium complete.
- Provide all track and field equipment.
- Provide street cleaning of mud, etc. on daily basis.
- Provide all site furnishings.
- Include all costs for temporary barricades, arrows, pedestrian protection, flagmen, etc. required to complete the work.
- Base bid shall include all standard dewatering measures; utilizing trenches, crocks, stone and portable pumping measures. This contractor to provide these measures as required to perform their work.
- The Contractor shall provide and maintain all temporary access road to and from the work areas.
- Temporary water will be the responsibility of the individual Contractors. The Construction

Manager will not provide this service.

- Install topsoil on entire site areas per plans/ material from on site stockpile.
- Provide all lawn areas as indicated on drawings.
- Provide alternates to supply meadow planting in lieu of standard turf.
- Provide all planting and mulching as indicated.
- Provide all utility connections as indicated including all taps and distribution in all areas documented for Bid Package G.
- Contractor to provide a $40,000 allowance for work to be determined by the Construction Manager.
- Provide irrigation trunk lines as indicated on plans.
- Provide and install perimeter berm around designated are of project site. (Material to be used from on site stockpile.)
- This Contractor to provide all underfield drainage, curbs, and stone base layer graded to tolerance within final grade to be turned over to the turf contractor for final installation.
- This Contractor to provide grading, drainage, curbs, stone and paving in preparation fo the track contractor to perform their work.
- Contractor to provide an allowance of $35,000 for work to be designated by Construction Manager.
- Include CCR reporting for duration of construction.

CONTRACT NO. NDHS-34: GENERAL CONSTRUCTION

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Section 017419	Construction Waste Management and Disposal
Section 018113	Sustainable Design Requirements LEED for Schools
Section 033000	Cast-In-Place Concrete
Section 042000	Unit Masonry
Section 04 72 00	Cast Stone
Section 05 12 00	Structural Steel Framing
Section 05 21 00	Steel Joist Framing
Section 05 31 00	Steel Decking
Section 05 40 00	Cold-Formed Metal Framing
Section 05 50 00	Metal Fabrications
Section 06 10 00	Rough Carpentry
Section 06 20 00	Finish Carpentry
Section 07 21 00	Thermal Insulation
Section 07 26 16	Under-Slab Vapor Barrier/Retarder
Section 07 42 13	Metal Wall Panels
Section 07 53 00	Elastomeric Membrane Roofing
Section 07 62 00	Sheet Metal Flashing and Trim
Section 07 71 00	Roof Specialties
Section 07 72 00	Roof Accessories
Section 07 90 05	Joint Sealers
Section 08 11 13	Hollow Metal Doors and Frames
Section 08 33 23	Overhead Coiling Doors
Section 08 33 33	Coiling Counter Doors
Section 08 43 13	Aluminum-Framed Storefronts
Section 08 06 71	Door Hardware Schedule
Section 08 71 00	Door Hardware
Section 08 80 00	Glazing
Section 08 91 00	Louvers
Section 09 05 61	Common Work Results for Flooring Preparation
Section 09 21 16	Gypsum Board Assemblies
Section 09 51 00	Acoustical Ceilings
Section 09 65 66	Resilient Athletic Flooring
Section 09 67 00	Fluid-Applied Flooring
Section 09 68 13	Tile Carpeting
Section 09 90 00	Painting and Coating
Section 10 11 01	Visual Display Boards

Section 10 21 13.19	Solid Composite Toilet Compartments
Section 10 28 00	Toilet, Bath, and Laundry Accessories
Section 10 44 00	Fire Protection Specialties
Section 10 51 00	Lockers
Section 11 40 00	Foodservice Equipment
Section 12 21 13	Horizontal Louver Blinds
Section 12 34 00	Laminate Clad Casework
Section 12 36 00	Countertops, Backsplashes and Window Stools

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

This contract will be for the General Building package associated with the ancillary buildings located throughout the site of Dover High School. They include the following:

- North Building Fieldhouse
- East Building Fieldhouse
- West Building Fieldhouse
- Maintenance Building
- Ticket Booths (Alternate)
- Dugouts

It will be the responsibility of NDHS- Contract 34 to provide these building in their entirety from subgrade to final acceptance. This includes all building construction as well as the MEP work required. The Owner will provide the building permit. The Contractor will be responsible for all other permits required by the City of Dover, Kent County or any other governing agency having jurisdiction over this work site.

- This Contractor to provide secure dry storage for all doors, frames and hardware until work has been installed.

- All field trimming required to adjust to existing conditions.

- This Contractor shall include in the base an allowance of $30,000 for work to be determined by the Construction Manager.

- This Contractor shall at a minimum provide a fire extinguisher rated not less than 2A for each structure while construction is underway.

CONTRACT NO. NDHS-35: TURF FIELD & TRACK

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Division 2	Sitework
Section 32 18 16.16	Artificial Turf
Section 37 18 17	Synthetic Track Surfacing System

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

- This Contractors work to start at the top of the vertical drawing gravel blanket. Provide complete turf field system.
- Provide warranty as specified.
- Provide an IAAF approved synthetic track system.
- Coordinate with work of site contractor to ensure a timely installation of work under your scope.
- Contractor to include an allowance of $201,000 for work to be determined by Construction Manager.

CONTRACT NO. NDHS-36: FENCING, GATES & BACKSTOPS

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Division 32	Exterior Improvements
Section 323113	Chain Link Fences and Gates
Section 313115	Ornamental Steel Fencing

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

- All chain link fencing, gates, backstops, dugouts and ornamental fencing as indicated in contract documents.
- Supply and install all concrete foundations and setting pads for the scope of your work.
- Provide and install "grounding connections" as required.
- Warranty period five (5) years from date of substantial completion to be included in your proposal.
- All work areas to be cleaned up daily. Removal of debris, trash and excess materials to be the responsibility of this contractor.
- Include an allowance of $20,000 for work to be determined by Construction Manager.

CONTRACT NO. NDHS-37: SITE CONCRETE

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Division 3	Concrete
Division 31	Earthwork
Section 0330000	Concrete

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

- Provide all concrete, sidewalks, aprons, pads seats and concrete paving.
- Provide curbs associated with sidewalks and paved areas.
- This Contractor will be responsible for laying out all concrete work as shown on the contract documents.
- This Contractor to furnish and install reinforcing steel, admixtures, curing compound, sealers as required in the Contract Documents.
- Provide and install insulation as related to your work.
- Underslab vapor barrier, insulation, reglets, waterstops, control and construction joints (including required caulking at control and construction joints).
- Placement of related items furnished under other specification sections.
- Anchor bolts and leveling plates to be installed by this Contractor and furnished by others. Installation within required tolerances. Anchor bolt assemblies to be placed with templates only.
- All blockouts and embedments required by plans and specifications.
- This contractor to perform all scoring, coloring and cutting of concrete as detailed.
- The contractor to supply and install all wheel stops.
- ADA truncated domes and markings to be supplied and installed by this contractor.

- Provide and install all joint sealants associated with your work.

- Daily clean up of your work area is required by this contractor. You will be responsible for removal of all debris and trash you accumulate.

- Include all excavation, backfill, stone base, vapor barriers, etc. as required to perform your work.

- This Contractor shall include an allowance of $25,000 for work to be determined by Construction Manager.

CONTRACT NO. NDHS-38 BLEACHER & GRANDSTANDS

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Division 3	Concrete
Division 13	Special Construction
Section 033000	Cast-in-place Concrete

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

- Bleachers as designed and indicated on plans and specifications.
- Provide all engineering, materials, freight, concrete, reinforcing bar, installation, related sitework and supervision to provide grandstand seating systems.
- This contractor shall be responsible for any local permitting and code compliance.
- Shop drawings, submittal product data shall be submitted per contract documents.
- Warranty period to be no less than two (2) years.
- Clean up of all debris from work of this contractor to be included daily.
- Include an allowance of $15,000 for work to be determined by Construction Manager.

CONTRACT NO. NDHS-39 SITE ELECTRICAL

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Division 23	Mechanical
Division 26	Electrical
Division 31	Earthwork
Section 03 30 00	Concrete

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

- Provide a complete site lighting package including all bases, conduit and wire.
- Excavation and backfill for underground electrical work as required below is the responsibility of this Contractor. Soil types shall be in accordance with Del DOT standard specifications.
- Backfilling is the responsibility of this Contractor. Soil types shall be in accordance with project documents.
- Concrete for duct banks, light standards, above ground conduit encasement, equipment bases and any other concrete work specifically related to the electrical work. Include requirements of Kent County, State and local codes for concrete encasement.
- Rough in and final connection and related work for site lighting, stadium lighting and scoreboards.
- Permits and inspections.
- Penetrations through walls, floors, etc. including cutting, patching and fire safing.
- Testing.
- Clean up.
- All guarantees and warranties to begin at the substantial completion of the entire project. Maintain equipment prior to substantial completion.
- Hoisting, rigging and scaffolding.

- Provide all primary service work, including all utility company related costs/fees for this work.
- Grounding of all work related to your scope.
- Complete stadium sound system.
- As-built drawings.
- All light poles and wiring.
- Furnish and install complete gear package.
- Furnish and install complete sound system.
- Furnish and install complete conduit and wiring system per drawings.
- Contractor to include $35,000 allowance for work to be designated by Construction Manager.

CONTRACT NO. NDHS-40: OUTDOOR SCOREBOARDS

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Section	Outdoor Scoreboards

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

- Furnish and install all outdoor scoreboards as detailed in the Contract Documents.
- Include all necessary excavation, concrete, rebar, conduits, wiring and accessories.

END OF SECTION

SECTION 01 21 00 - ALLOWANCES

1. RELATED DOCUMENTS

1.1 The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 Refer to provisions in AIA General Conditions A201/CMa – 1992 Edition, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION WHERE THE CONSTRUCTION MANAGER IS NOT A CONSTRUCTOR, for requirements in addition to those specified in Division 1.

1.3 Refer to Scope Information Sheets for all contracts bound in the Project Manual under Section 01 11 00 - SUMMARY OF WORK. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

1.4 For work being constructed under separate prime contracts, provisions of this Section apply to each contract being bid.

1.5 Include in the Contract Sum all lump sum and unit cost allowances stated in the Contract Documents.

1.6 Designate in the construction progress schedule the delivery dates for products specified under each allowance.

1.7 Designate in the Schedule of Values the quantities of materials required under each unit cost allowance.

2. ALLOWANCES FOR PRODUCTS

2.1 The amount of each allowance includes:

A. The cost of the product or labor to the Contractor or Subcontractor, less any applicable trade discounts.

B. Delivery to the site.

C. Labor required under the allowance, only when labor in specified to be included in the allowance. If labor is not specified to be included in the allowance, it shall be included in the Contractor's bid and in the resulting Contract Sum.

D. Applicable taxes.

E. Profit and overhead.

2.2 In addition to the amount of each allowance, include in the Contract Sum the Contractor's costs for:

A. Handling at the site; including unloading, uncrating and storage.

B. Protection from the elements and from damage.

C. Labor for installation and finishing, except where labor is specified to be a part of the allowance.

D. Other expenses required to complete the installation.

E. Contractor's and Subcontractor's overhead and profit.

2.3 Refer to Scope Information Sheets under Section 01 11 00 - SUMMARY OF WORK for the amount of each lump sum allowance and for work specified in the specification sections listed below.

A. Section 02072: Provide labor under direction of CM.

3. ADJUSTMENT OF COSTS

3.1 Should the net cost be more or less than the specified amount of the allowance, the Contract Sum will be adjusted accordingly by Change Order.

A. For products and labor specified under a unit cost allowance, the unit cost shall apply to the quantities actually used with a nominal allowance for waste, as determined by receipted invoices, or by field measurement.

3.2 At Contract closeout, reflect all approved changes in Contract amounts in the final statement of accounting.

END OF SECTION

SECTION 01 22 00 - UNIT PRICES

1. GENERAL PROVISIONS

1.1 The general provision of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 Refer to provisions in AIA Document A201/CMa - 1992 Edition, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION WHERE THE CONSTRUCTION MANAGER IS NOT A CONSTRUCTOR, for requirements in addition to those specified in Division 1.

1.3 For work being constructed under separate prime contract, provisions of this Section apply to each contract being bid.

2. BASE BID

2.1 The Base Bid shall consist of all work shown or specified in the Contract Documents, exclusive of any Additive Unit Prices specified herein.

.2.2 The Base Bid shall include all work in any Subtractive Unit Prices specified herein.

3. UNIT PRICES

3.1 State in the Bid Form the amount to be added to (or subtracted from) the Base Bid per unit of measurement for each Unit Price specified. State this amount to include all overhead and profit. No surcharge in addition to the Unit Price listed will be permitted.

3.2 See Section 00 21 13, INSTRUCTIONS TO BIDDERS for related information.

3.3 For description of Unit Prices requested, refer to the specification. The method of stating the Unit Prices is described in the Bid Form.

3.4 Where both add and deduct unit prices are requested, there shall not be more that a 10% variation between the two.

4. APPLICATION OF UNIT PRICES

4.1 Unit prices stated in the Bid Form will apply from the time the Bid is submitted until Contract completion.

5. MEASUREMENT OF QUANTITIES

5.1 Quantities shall be determined by field measurement by contractor personnel and as

verified by the Construction Manager.

5.2 At the Contractor's option, and at his expense, measurement may be made by a registered surveyor.

6. LIST AND DESCRIPTION OF UNIT PRICES

N/A

END OF SECTION

SECTION 01 23 00 - ALTERNATES

1. GENERAL PROVISIONS

1.1 The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 Refer to provisions in AIA Document A201/CMa - 1992 Edition, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION WHERE THE CONSTRUCTION MANAGER IS NOT A CONSTRUCTOR for requirements in addition to those specified in Division 1.

1.3 For work being constructed under separate prime contracts, provisions of this Section apply to each contract being bid.

2. BASE BID

2.1 The Base Bid shall consist of all work shown or specified in the Contract Documents, exclusive of any Additive Alternates specified herein.

2.2 The Base Bid shall include all work in any Subtractive Alternates specified herein.

3. ALTERNATES

3.1 State in the Bid Form the amount to be added to the Base Bid for each Alternate specified.

3.2 See Section 002113 - INSTRUCTIONS TO BIDDERS for related information.

3.3 The description of Alternates contained herein is in summary form. Detailed requirements for materials and execution shall be as specified in other sections and as shown on drawings.

Alternate BPG-25: Add Remote Athletics Building.

Add $_____

Alternate BPG-26: Add Maintenance Building.

Add $_____

Alternate BPG-27: Add for Enlarged Football Bleacher Design – Main Stadium.

Add $_____

Alternate BPG-28: Add Soccer Bleachers – Auxiliary Stadium.

Add $_____

Alternate BPG-29: Add (4) Tennis Courts.

Add $_____

Alternate BPG-30: Add Ticket Booths and Signage Structures – Main & Auxiliary Stadium.

Add $_____

Alternate BPG-31: Add Canopies above Entry Gates – Main Stadium.

Add $_____

Alternate BPG-32: Add Lighting / Light Bases at Tennis Courts.

Add $_____

Alternate BPG-33: Add Lighting / Light Bases at Baseball / Softball Stadiums.

Add $_____

Alternate BPG-34: Add for "Blue" Color for all Synthetic Running Surfaces (in lieu of "Red").

Add $_____

Alternate BPG-35: Add Synthetic Athletic Turf at Main Baseball / Main Softball Stadium's playing surfaces.

Add $_____

Alternate BPG-36: Add Unit Paving Areas (in lieu of Scored Concrete).

Add $_____

Alternate BPG-37: Add Flagpole Plinth Monuments.

Add $_____

END OF SECTION

SECTION 012600 - CHANGE ORDER PROCEDURES

1. GENERAL:

1.1 The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 Refer to provisions in AIA Document A232 – 2009 EDITION, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, CONSTRUCTION MANAGER AS ADVISOR EDITION, for requirements in addition to those specified in Division 1.

1.3 The Construction Manager is responsible for processing all change orders. Each request will be assigned a change order request (COR) number. The Change Order Request & Execution Form will be initiated via the web-based project management system (Building Blok) used by the CM.

1.4 It is to be clearly understood that no extra work shall commence without an approved written and executed change order from the Owner.

2. INITIATING A CHANGE ORDER:

2.1 Specific changes initiated by the Owner, Architect, Construction Manager (CM) or Contractor will be processed as follows:

A. The Owner will authorize the Architect to prepare sufficient documents to establish an accurate price. These documents to be forwarded to the Construction Manager and Owner "for pricing only, not authorized for construction." The Construction Manager will develop the estimate (within 2 weeks) showing a breakdown by trades with all trade contractor quotes. The Owner will approve or reject the change request within two (2) weeks. If the Owner elects to proceed with the change, the Construction Manager will prepare formal change orders to the various trade contractors involved in the change and reference in all formal change orders the original change order request number.

B. Field Change: Contractor shall immediately notify the Construction Manager of a change due to field conditions or site conditions. If documents cannot be prepared for pricing due to schedule constraints, the Construction Manager will make every effort in estimating the field change. If the Owner and Construction Manager agree that certain field changes should be handled on a time and material basis, the Construction Manager will closely monitor the Contractor's labor and material affecting this change. At the completion of the work a formal change order will be issued.

C. Contractor Change: If a Contractor initiates a change order for work not included in the Contract, the Construction Manager and Architect will research the validity of the request, verify quantities and pricing and submit to the Owner for approval on a

change order request.

2.2 The additional cost, or credit to the Owner resulting from a change in the Work shall be by mutual agreement of the Owner, Contractor, Construction Manager and the Architect.

3. PROCESSING A CHANGE ORDER:

3.1 The Contractor will fill in the Change Order Request & Execution Form (COREF) with a brief description of the change, any time extension, and cost changes.

3.2 The Contractor will attach to the COREF copies of the written quotations from the trade contractors, Contractors, and suppliers. The Labor Detail Sheet and the Change Order Detail forms must be added as an attachment to the COREF. The Contractor and each sub-tier contractor (as applicable) must fill out the Labor Detail Sheet and Change Order Detail Sheet. Samples of these forms are attached.

3.3 In all cases, this cost or credit shall be based on the "DPE" wages required and the "invoice price" of the materials/equipment needed.

3.4 "DPE" shall be defined to mean "direct personnel expense". Direct payroll expense includes direct salary plus customary fringe benefits (prevailing wage rates) and documented statutory costs such as workman's compensation insurance, FICA, and unemployment insurance.

A. "Fringe Benefit" is any medical, life or disability insurance, paid time off, etc.

B. "Worker's Compensation" is the insurance required for injuries including medical leave, etc.

C. "FICA" is the costs association with Social Security and Medicare insurance.

D. "Unemployment insurance" is the cost associated with the governmental assessment for employee's unemployment benefits.

3.5 "Invoice price" of materials/equipment shall be defined to mean the actual cost of materials and/or equipment that is paid by the Contractor (or Subcontractor) to a material distributor, direct factory vendor, store, material provider, or equipment leasing entity.

3.6 In addition to the above, the Contractor is allowed markup for overhead and profit on additional work performed as outlined in Specification Section 012613, Contractor Compensation.

3.7 Building Blok Procedures: The Contractor will submit all change order requests and supporting documentation via the Building Blok web-based project management system. Each Contractor will be issued a unique login and password. Each contractor must

submit the information as follows:

A. Create a new change order, from your "To-Do List" by clicking on the "Create Issue" tab in the upper right corner and select "Change Order Request".
B. The Contractor will enter a brief description of the change in the "Summary" block. A detailed description of the change will be entered in the "Description of Change" block, to include any changes to documents or time extension. The cost of the change will be entered in the "Total Cost Change" block.

C. The Labor Detail Sheet and the Change Order Detail forms must be added as an attachment to the request. The Contractor and each sub-tier contractor (as applicable) must fill out the Labor Detail Sheet and Change Order Detail Sheet. Samples of these forms are included behind this section. In addition to these forms, the Contractor also must attach any material and equipment rental quotations. All of these documents should be scanned and saved as a PDF file. Click on the "Browse" box to upload the file. Be sure to wait until Building Blok tells you the file was "Uploaded Successfully".

D. Once the information is entered on the form and the proper attachments are uploaded, the contractor will click "Save". The Contractor will be prompted to enter their password to approve an electronic signature. Once you save the request you will have an opportunity to check it before submitting it to the CM. After you verify the COREF is correct click "Recommend Approval" to submit the change request to the CM. The Contractor will then be prompted to re-enter the password to approve an electronic signature and complete the submission request. Click on "Home" in the upper left corner to make sure the change order does not appear on your To-Do List.

E. The Change Order Request will then be reviewed by the CM Project Manager and Recommended for Approval, Rejected, or returned to the Contractor for additional information. Once the Construction Manager, Owner, and Architect have approved the request all parties will receive an email from Building Blok notifying them that a fully executed Change Order and Contract Recalculation Form can be downloaded from Building Blok. Hard copies of the executed change order and recalculation form will not be provided by the CM.

It is to be clearly stated that no extra work shall commence without an approval from the **Owner or Construction Manager** or Owner's representative.

END OF SECTION

CHANGE ORDER REQUEST & EXECUTION FORM

110 South Poplar Street
Suite 400
Wilmington, DE 19801

Tel. 302-421-5700
Fax 302-421-5715

DATE:
CONTRACT:
CONTRACTOR:

PROJECT NAME:
REQUEST NUMBER:
CHANGE ORDER NUMBER:
STATE PO NUMBER:

The following is a summary of the request submitted by the contractor as described above. All supporting documents have been attached and described herewith. This summary shall contain a total amount of compensation requested by the contractor as well as any request for an extension in contract time. It shall be understood that the amounts described below shall remain valid for a period of sixty days from the date described above unless otherwise stated.

A detailed breakdown of Labor, material, equipment, and subcontract costs must be attached to be considered for review.

1. Summary Description(s):
2. Changes to the Contract Drawings:
3. Changes to the Project Manual:
4. Total Cost Change:
5. Total Time Change:

REVIEWED

This request has been reviewed and____approval_____disapproval is recommended by:

Name Title Date

APPROVED

This change order request is not approved until executed by all parties bound by a contractual relationship. Upon execution it shall represent a modification to the agreement and is subject to all terms and conditions of the contract documents.

Contractor:	Architect:
Signed By:	Signed By:
Title:	Title:
Date:	Date:
EDiS Company	Owner:
Signed By:	Signed By:
Title:	Title:
Date:	Date:

CHANGE ORDER DETAIL FORM

(Provided by contractor, subcontractor or sub tier contractor)

DATE SUBMITTED:

CONTRACT:

CONTRACTOR:

PROJECT NAME:

CHANGE ORDER REQUEST #:

LABOR SECTION

TRADESMAN(s):	LABOR HOURS	RATE (per schedule)	SUBTOTAL
Subtotal			

MATERIAL SECTION

MATERIAL:	QUANTITY	UNIT COST	SUBTOTAL
Subtotal			

EQUIPMENT SECTION

EQUIPMENT:	QUANTITY	UNIT COST	SUBTOTAL
Subtotal			

SUBTOTAL	
SUBCONTRACTOR/ SUB TIER*	
OH & PROFIT (10% on sub/sub tier only))	
BOND COST	
OH & PROFIT (15% on own work)	
GRAND TOTAL	

SECTION 01 26 13 - CONTRACTOR COMPENSATION

1. GENERAL

1.1 The Contractor agrees to perform any additional Work, for the net cost of materials and labor (including wages paid, payroll taxes, and all insurance) plus the following percentage for all of his overhead and profit, which includes Field Supervision:

The percentages to be added or allowed for any Work change involving both added Work and omitted Work shall be applied only to the net difference in cost.

(a) 15% mark-up (10% overhead and 5% profit) by the Contractor on Work performed by his own forces.

(b) For work done by a Subcontractor, 10% for subcontractor overhead and 5% for subcontractor profit to which the Contractor may add 7.5% for his overhead and profit combined.

(c) Contractor mark-up shall include supervision, home and field overhead, all self-owned small tools and equipment.

1.2 When the Contractor is directed to perform overtime work at the CM (Owner) expense to accelerate contractual work, the cost for same shall only be the actual premium costs incurred by the Contractor.

END OF SECTION

SECTION 01 29 00 - PAYMENT PROCEDURES

1. GENERAL PROVISIONS

1.1 The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 Refer to provisions in either AIA Document A201/CMa - 1992 Edition, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION WHERE THE CONSTRUCTION MANAGER IS NOT A CONSTRUCTOR for requirements in addition to those specified in Division 1.

1.3 For work being constructed under separate prime contracts, provisions of this Section apply to each contract being bid.

2. REQUIREMENTS INCLUDED

2.1 Submit Applications for Payment to Construction Manager in accordance with the schedule and procedures established in the Contract Documents.

3. RELATED REQUIREMENTS

3.1 Owner-Contractor Agreement.

3.2 Conditions of the Contract: Article 9 PAYMENTS AND COMPLETION.

3.3 Section 01 31 13: Project Meetings

3.4 Section 01 33 00: Submittals

3.5 Section 01 77 00: Contract Closeout

4. FORMAT AND DATA REQUIRED

4.1 Submit Schedule of Values and itemized applications through the Building Blok System.

4.2 Provide itemized data on Continuation Sheet:

1. Format, schedules, line items and values: Duplicates of those of the schedule of values previously accepted by the Construction Manager.

5. PREPARATION OF APPLICATIONS FOR PROGRESS PAYMENTS

5.1 Schedule of Values and Applications for Payment to be processed through the Building Blok Management Program.

6. PREPARATION OF APPLICATION FOR FINAL PAYMENT

6.1 Fill in Application form as specified in progress payments.

7. SUBMITTAL PROCEDURES

7.1 Complete Invoice:

1. Submit completed Application to the Construction Manager by the 25th of each month.

7.2 To be submitted through the Building Blok Management Program.

END OF SECTION

SECTION 01 31 13 - PROJECT COORDINATION MEETING

1. PROJECT COORDINATION MEETING

   1.1 An on-site project coordination meeting will be held on a biweekly basis throughout the project construction period.

2. ATTENDANCE

   2.1 Attendance at the project coordination meeting is mandatory of each Contractor or major supplier on the project.

   2.2 The representative of the Contractor shall be the Project Manager and field superintendent, unless a substitute representative has been approved by the Construction Manager.

   2.3 Contractor will begin attending the Project Coordination Meetings at least 4 weeks prior to mobilization on site, and will continue until the Contractor has fulfilled the obligations of his Contract.

3. AGENDA

   3.1 The Construction Manager will set the agenda for the biweekly Project Coordination Meeting.

   3.2 At a minimum, the Contractor shall be prepared to discuss the following:

      1. Actual vs. as planned progress for the prior two week period.

      2. Planned construction activities for the next four weeks.

      3. Contract document clarifications.

      4. Coordination items with other contractors.

      5. Quality Control.

      6. Recently issued change orders.

      7. Potential change orders.

      8. Submittals and shop drawings.

      9. Other items requiring Construction Manager's attention.

END OF SECTION

SECTION 01 31 16 - BIM MODELING COORDINATION DRAWING GUIDELINES

1. GENERAL

1.1 All Sheetmetal, Mechanical Piping, Plumbing, Fire Protection (FP), Electrical and ATC Subcontractors will be required to prepare 3D coordination drawing using the latest AutoCAD and Navisworks Clash Detective programs. Coordination drawings will be distributed via email and/or disk. The mechanical piping and plumbing work may be awarded to the same subcontractor so some steps such as emailing amongst themselves may not apply; the procedures contained herein will generally be the same. All costs shall be included in the contractors bid.

NOTE: The coordination drawings will be administered through the Building Blok Project Manager system. See Section 01 12 50 Web Based Project Manager System for Construction.

1.2 Contract architectural, MEP and structural drawings (3D) will be available electronically from the designated FTP site.

1.3 All ductwork, piping and electrical systems shall be thoroughly dimensioned as to location and height above finished floor. Each different system will be drawn in a different color. Yellow shall not be used. Text shall be uniform in size across all trades. Object blocks (i.e. sprinkler heads) shall be indicated close to their actual size. Piping 2" and larger shall be indicated as a double line. Insulation thickness of pipes and duct shall be indicated.

1.4 The Sheetmetal Subcontractor will take the lead and develop a drawing list for approval by the Construction Manager subdividing the buildings into separate areas of zones. The drawing list will be for submission and will indicate a submission schedule coordinated with the construction activities. The drawings shall be developed in a sequential fashion so as to not delay installation of the work or the overall project schedule. The Sheetmetal Subcontractor shall include a master key plan so that the area of each drawing can be readily identified as to the location within each building. The Construction Manager shall prepare a schedule identifying the activity and duration of each submission.

1.5 Following a coordination kick-off meeting, a list of each subcontractor, their coordination contact person, phone number and email addresses will be generated and distributed to all parties. As each drawing is completed, it is to be emailed to each party on the coordination list.

1.6 The Sheetmetal Subcontractor shall maintain a weekly status log on the Building Blok System. Each subcontractor is responsible to submit and coordinate his work with each trade.

1.7 Preparation of coordination drawings shall commence at the issuance of a letter of intent. The coordination drawings may lack data in certain instances pending receipt of equipment drawings, but sufficient space shall be allotted for the items affected. When final information is received, such data shall be promptly inserted on the composite by that subcontractor.

1.8 Coordination drawings shall indicate clearances for servicing and accessing equipment, including space for equipment disassembly required for periodic maintenance.

1.9 Coordination is the responsibility of all MEP subcontractors; the Sheetmetal Contractor shall assign a project manager dedicated to oversee this process. The Sheetmetal Project Manager will call meetings, weekly, or as required, which subcontractors must attend to avoid delay. Failure to attend will require the subcontractor to field run the work not coordinated. No extra compensation will be paid to any subcontractor for relocating any equipment, duct, pipe, conduit or other material that has been installed without proper coordination. If the installation of any uncoordinated work or improper installation or coordinated work necessitates additional work by other Subcontractors, The cost of such additional work shall be assessed to the Subcontractor responsible as determined by the Construction Manager.

1.10 At the conclusion of each composite drawing(s) coordination process, the Sheetmetal Subcontractor will notify the Construction Manager whereupon an on-site coordination meeting will be scheduled for the purpose of signing off on each respective drawing(s). Each Subcontractor will not be authorized to release any material for fabrication or installation until the composite drawing(s) has been prepared and the signature process is executed and approved by the Construction Manager.

1.11 Coordination drawings of the underground and underslab piping by the plumbing Subcontractor and electrical work will be required. These drawings shall be prepared in 3D modeling software. The Plumbing Contractor shall proceed in the preparation of the coordinated underground plumbing drawings. The Plumbing Contractor shall add to the background drawings pertinent information such as footings, grade beams, column piers, etc. into the background. The Plumbing Contractor shall include location, invert, size and plumbing accessories, dimensioned to centerline of adjacent columns. At the completion of this work, the Plumbing Contractors will E-mail their work to the Electrical Contractor for incorporation of all below slab electrical conduit and electrical utilities. Upon completion of this work, the Plumbing Contractor shall prepare a coordinated underground composite plan for sign-off a described in Paragraph 1.22 below:

1.12 As soon as practical, the Sheetmetal Subcontractor will coordinate the background model of all architectural elements of the building indicating all walls, partitions,

columns, concrete beams, structural steel with bottom of steel elevations, windows, doors, room numbers, ceiling heights, ceiling types, and ceiling layouts, floor elevations and other structural and architectural features. The Sheetmetal Subcontractor shall prepare but not limited to reflected ceiling plans showing the location of light fixtures (which shall include depths), speakers, smoke/heat detectors, fire alarm horn/strobes, sprinklers, grilles, registers, diffusers and any other components requiring coordination. In addition, the Sheetmetal Subcontractor shall inform the Project Manager of any changes in layouts or dimensions as may be issued during the coordination process through addendums, bulletins, RFIs etc. The Sheetmetal Subcontractor shall electronically forward these background drawings to all participants.

1.13 Once the layout drawings are prepared all subcontractors shall incorporate all equipment and panels into the model prior to the Sheetmetal Subcontractor proceeding with their own work. Thereafter the Sheetmetal Subcontractor will prepare layout drawings of all ductwork. These drawings will show all wall fire ratings, registers, grilles, diffusers and similar features as well as locations of all valves, dampers, damper operators and other items requiring access for maintenance. All dimensions should be from centerlines of columns and ductwork elevations shall be from finished floor slab.

1.14 The Sheetmetal Subcontractor upon completion of his work will electronically forward his data to the Mechanical Piping Subcontractor and copy all participants. The Mechanical Piping Subcontractor shall download the sheetmetal data and incorporate, by separate layer, their own piping routing, valves (including control valves) with valve tags, as well as other areas requiring access for service and maintenance to determine their relationship and possible interference with the mechanical, architectural or structural features to be performed as part of the work.

1.15 The Mechanical Piping Subcontractor upon completion of his work will electronically forward his data to the Plumbing Subcontractor and copy all participants. The Plumbing Subcontractor shall download the sheetmetal and piping data and incorporate, by separate layer, their own routing as well as other areas requiring access for service and maintenance to determine their relationship and possible interference with the mechanical, architectural or structural features to be performed as part of the work.

1.16 The Plumbing Piping Subcontractor upon completion of his work will electronically forward his data to the FP Subcontractor and copy all participants. The FP Subcontractor shall download the drawing and incorporate, by separate layer, their own routings as well as other areas requiring access for service and maintenance, to determine their relationship and possible interferences with the mechanical, electrical, plumbing and architectural or structural items to be installed as part of the overall work.

1.17 The Fire Protection Subcontractor will then electronically forward his data to the Electrical Subcontractor(s) and copy all participants. The electrical Subcontractor shall download the drawing and incorporate, by separate layer, their own routings of conduit equal to or greater than 2", bus ducts, cable tray, junction boxes, as well as the depth of all light fixtures, access panels, etc. as required to determine the relationship and possible interferences with the plumbing, mechanical, architectural or structural items to be installed as part of the overall work. In addition the Electrical Subcontractor shall indicate the location of all electrical panels, substations, switchgear, and MCC's. The Electrical Subcontractor will be responsible to verify that the electrical lighting layout shown on these drawings is correct and to make corrections and additions of all other light fixtures as required. In areas where no mechanical work occurs, but where other crowed electrical installations are evident, the Electrical Subcontractor shall prepare similar drawings.

1.18 The Carpentry Subcontractor shall review each issuance of every drawing to determine any possible interference with wall, soffit or ceiling construction and resolve with the respective subcontractors. The ATC Subcontractor shall review each issuance of every drawing to determine any possible interference regarding locations of controls to ensure sufficient access to them is being maintained.

1.19 The Sheetmetal Subcontractor shall provide one color composite set of drawings and forward them to the Construction Manager. This composite will then be reviewed during meetings determined by the Construction Manager at which all subcontractors shall be represented in order to review and resolve any real or apparent interference or conflicts.

1.20 In the preparation of all the final composite drawings, large scale details as well as cross and longitudinal sections shall be made as required to fully delineate all conditions. Particular attention shall be given to the locations, size and clearance dimensions of equipment items, shafts and similar features. The final composite drawings shall include the locations of all controls, tie-ins, connections for other subcontractor's work, and pipe and duct insulation as required. Each trade subcontractor indicating their acceptance and approval of the indicated routings and layouts and their relationship with the adjoining or contiguous work of all subcontractors shall then sign off these final composite drawings. Therefore, no unauthorized deviations will be permitted. If deviations are made without the knowledge and agreement of the Construction Manager and other affected Subcontractors, the work in question will be subject to removal and correction at no additional cost to the Owner.

1.21 In preparing the composite drawings, minor changes in duct, pipe or conduit routings that do not affect eh intended function may be made as required to avoid space conflicts, when mutually agreed. Items may not be revised, exposed items relocated or items run exposed when not intended without approval. No changes shall be made in any structural members or architectural features which affect the

function or aesthetics of the buildings. If conflicts or interferences cannot be satisfactorily resolved, the Architect shall be notified and his decision obtained.

1.22 After final composite drawings have been accepted and approved, the Sheetmetal Subcontractor shall print one (1) color copy to be signed by all subcontractors. The Sheetmetal Subcontractor shall provide and distribute two (2) prints to each of the subcontractors, and two (2) set of prints for submittal purposes to the Construction Manager. Subcontractors requiring further prints for their own distribution go to Building Blok to download. The original signed off drawing shall be sent to the Construction Manager for permanent possession.

1.23 The record copies of final composite drawings shall be retained by each subcontractor as a working reference. All shop drawings, prior to their submittal to the Construction Manager shall be compared with the composite drawings and developed accordingly by the subcontractor responsible. Any revisions to the composite drawings, which may become necessary during the process of the work, shall be noted by all subcontractors and shall be neatly and accurately recorded on the record copies. Each subcontractor shall be responsible for the up-to-date maintenance of his own record copies of the composite drawings and to keep one (1) copy available at the site. The composite drawings and any subsequent changes thereto shall be utilized by each subcontractor in its development of the as-built drawings. Note: the coordination drawings may be used as "As-builts" (with appropriate changes and changing to title block).

2. COORDINAITON FOR ELECTRICAL AND CONTROLS

2.1 The Electrical Subcontractor and the ATC Subcontractor will prepare coordinated floor plan drawings of electrical, control devices and panel locations on architectural floor plans using 3D modeling software. All devices and panels shall be indicated on these plans with indication of the location from nearest end wall or column and the mounting height from finished floor.

2.2 The Electrical Subcontractor and ATC Subcontractor will prepare coordinated electrical and special systems room drawings indicating all electrical, ATC , fire alarm, security, nurse call and telecommunications panels, equipment and devices using a 3D modeling software.

2.3 Devices indicated on the plans shall include but not be limited to receptacles, switches, emergency power off switches, dimmers, sensors, wall mounted exit lights, fire alarm horns and strobes, fire alarm pull stations, security devices, nurse call, thermostats, humidistats, tele/data outlets and all special systems.

2.4 Panels indicated on the plans shall include but not be limited to lighting, power, receptacles, BAS/ATC, security and fire alarm.

2.5 Plans shall show the necessary clearances in front of each panel as required by electrical codes.

2.6 The Carpentry Subcontractor shall review these plans and coordinate the spacing of wall studs and location of blocking to allow for the installation of the devices and panels per these coordinated drawings.

2.7 Failure to properly perform this coordination may require the relocation of the devices after they are installed. The subcontractor will be responsible for all relocation costs incurred which may involve but no limited to reframing work, drywall repairs and repainting.

3. COORDINATED SLEEVE DRAWINGS

3.1 The Sheetmetal, Plumbing, Mechanical, Fire Protection, Electrical and ATC Contractors will prepare coordinated floor and wall sleeve opening drawings for review by the Structural Engineer.

3.2 The above work will be for foundation walls and slabs only.

3.3 Coordinated drawings shall differentiate between those openings that are already indicated on the contract drawings, openings that will be sleeved prior to the floor or wall being poured and those openings that will be core-drilled.

END OF SECTION

SECTION 01 31 19 – PRE-INSTALLATION MEETINGS

1. PRE-INSTALLATION MEETINGS

1.1 An on-site pre-installation meeting will be held at least two weeks prior to commencement of installation of work.

2. ATTENDANCE

2.1 Attendance at the pre-installation meeting is mandatory of each Contractor and/or major supplier as required for each specific meeting listed below.

2.2 The following individuals shall attend these meetings:
- Contractors' Project Manager
- Contractors' Field Superintendent
- Contractors' Safety Representative (as needed)
- Key Subcontractors, Suppliers, and Vendors
- EDiS Project Manager
- EDiS Field Manager
- EDiS Safety Director (as needed)
- EDiS MEP Specialist (as needed)
- Owner's Representative (as needed)
- Architect/Engineer (as needed)
- Governmental Agency Representatives (as needed)
- Testing/Inspection Agency Representatives (as needed)
- Utility Company Representatives (as needed)

3. SUBMITTALS

3.1 Each contractor is responsible to have all submittals and mock-ups, as related to the pre-installation meeting scope of work, submitted and approved prior to commencement of the pre-installation meeting.

4. LIST OF REQUIRED MEETINGS

- Sitework – Erosion and Sediment Control
- Sitework
  - Bulk Grading
  - Asphalt Paving
  - Concrete Curbs, Gutters, & Sidewalks
- Landscaping
- Site Utilities
- Foundations & Concrete Slabs
- Underslab Utilities
- Structural Steel Erection & Miscellaneous Metals OSHA mandated Safety Meeting
- Roofing OSHA mandated Safety Meeting

- Building Envelope
    - Exterior Structural Stud Assembly
    - Masonry & Stone
    - Curtain Wall/Glazing/Storefronts
- Doors/Frames/Hardware
- Interior Glass and Glazing
- Finish Carpentry & Millwork
- Acoustical Ceilings/Acoustical Wall Panels
- Paint and VWC
- Flooring (VCT, Carpet)
- Terrazzo Flooring
- Hydraulic Elevators
- Kitchen Equipment
- Athletic Courts and Equipment
- Partition Walls
    - Metal Studs
    - Drywall
    - Insulation
    - Doors/Frames/Hardware
- Loading Dock Equipment
- Hydraulic Elevators
- Fire Protection
    - Fire Sprinkler Systems
    - Fire Alarm Systems
    - Ansul System
- MEP Coordination
    - Mechanical Piping Roughin
    - Plumbing Roughin
    - Insulation
    - Electrical Roughin
    - Electrical – Bonding, grounding, lightning protection
    - Automatic Temperature Controls
    - Commissioning
- Voice/Data Low Voltage Wiring
- Security System
- Audio-Visual Equipment
- Owner Furnished Equipment
- Final Cleaning

5. AGENDA

3.1 At a minimum, the Contractor shall be prepared to discuss the items as listed on the agenda template shown on the following page:

PROJECT: _____

PRE-INSTALLATION MEETING : (Insert Phase of Work)

A. ATTENDEES:

NAME	COMPANY	WORK ITEM	CONTRACT

B. TESTING & INSPECTION REQUIREMENTS ***(THESE REQUIREMENTS COME FROM THE PROJECT MANUAL)***

C. REVIEW CONTRACT DRAWINGS AND SPECIFICATIONS

Drawing / Spec No.	Comments / Conflicts

D. REVIEW SCOPES OF WORK ***(SEE SECTION 01010 IN THE PROJECT MANUAL)***

E. REVIEW RELEVANT RFI'S

F. REVIEW SUBMITTALS *(SEE THE SUBMITTAL REGISTER)*

G. REVIEW MATERIALS AND DELIVERIES

H. JOB SITE SAFETY *(SEE THE CONTRACTOR'S SAFETY PROGRAM OR OSHA)*

- Safety Plans must be submitted before the start of work
- Certificates of Insurance need to be submitted before the start of work
- Minimum PPE – Hardhats, steel toe boots, safety glasses
- Lock-out, Tag, Test and Try ALL utilities is critical before the start of demolition
- Signage & HAZCOM Requirements
- Potential Hazards
    - Excavations >4 ft
    - Slips/trips/falls
    - Existing utilities to remain and protected
    - Overhead debris
    - Power tools
    - Heavy equipment

I. COORDINATION WITH OTHER TRADES

J. ACTION ITEMS AND RESPONSIBILITY

END OF SECTION

SECTION 01 31 25 – WEB-BASED PROJECT MANAGEMENT SYSTEM

1. GENERAL PROVISIONS

1.1 The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 Refer to provisions in AIA Document A201 – 2007 EDITION, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, for requirements in addition to those specified in Division 1.

1.3 Refer to Scope Information Sheets for all contracts bound in the Project Manual under Section 011100 - SUMMARY OF WORK. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

1.4 All Contractors shall use Internet/Web-based project management software to transmit documents, track, and otherwise manage this project.

1.5 Use of this project management software will not change any contractual responsibilities of the construction team members.

2. DEFINITIONS

2.1 System: A real time web-based software that shares data, translates data, organizes data, facilitates communication, archives actions, and offers scheduling prompts to identified Users.

2.2 Users: Authorized participants of this project furnished with a unique password and authorized to access the system to view/input/export data. Owner, Construction Manager, Architect, and the Contractors are all Users. Other Users may be added as necessary.

2.3 Contacts: Entities identified to automatically receive specific transmissions or entities selected to receive specific information sent by the system through to an e-mail address.

2.4 Signees: Those individuals identified, by the Contractors, authorized to sign change orders and payment applications via electronic signature. This electronic signature is as contractually binding as an original signature on paper.

3. USE OF SYSTEM

3.1 The use of the system is mandatory for the documentation of the transmittal of all non-oral information, even if the actual transmission of the information is by another means.

3.2 The use of the system will be mandatory by the Contractors to send, retrieve, and respond to data.

3.3 In addition to this web-based project management system, the Contractors will be required to use electronic mail (email) for day-to-day communication and correspondence. Email will be the primary means of transmitting written communication (i.e. meeting minutes, draft pay applications, etc.).

4. QUALITY ASSURANCE

4.1 A three hour training session in the use of the software for this project will be offered by the Construction Manager at a location convenient to the project site. Attendance by one member of each Contractor's organization is mandatory. Additional attendees may enroll based on availability of training space. All attendees must have a working knowledge of computers. Training can not begin until three working days after the receipt of the submittals indicated below.

4.2 Technical assistance will be provided by on-line help, email, or telephone for all Users throughout the life of the project.

5. SUBMITTALS

5.1 Submit to the Construction Manager, within 5 days following the receipt of the letter of intent to award, in an electronic template, the following:

a. Electronic logo of organization (as needed)
b. Names, mailing address and electronic address of its Users and Contacts.
c. Designation the role/responsibility for each User

6. SOFTWARE AND HARDWARE REQUIREMENTS

6.1 Each User shall provide and maintain a computer with high speed internet access and an email address. The computer shall have a high speed internet browser (Internet Explorer 8.0 or higher, Firefox version 3.6.12 or higher, Google Chrome or Safari version 5.0 or higher) and a high speed cable Internet access, high speed DSL or T1 line.

6.2 License(s) to Use System - Each Contractor will be provided unlimited licenses to use the system for this project. Each license will allow secure unlimited usage from the notice to proceed until the original contract completion date.

7. SYSTEM DESCRIPTION

7.1 The web based project management system is a "secure, real-time, interactive, centralized database" specifically established and maintained for the management of this construction project. The product is designed to facilitate communication and improve the time management of its users by facilitating the sharing of information. Information will be available 24/7, from any computer meeting the specifications listed above. The information is fully protected. The

electronic platform allows information to be transmitted across the internet reducing printing and postage costs and the time associated with such activities.

7.2 The system contains a directory of the project participants.

7.3 The system includes templates, with the CM's letterhead, for each document created inside the system. The template allows the use of "pull down" menus to complete significant portions of each document.

7.4 The system allows the templates (and attached documents created outside the system) to be distributed to Users and Contacts.

7.5 The System contains "translation software" to permit the viewing (and marking) of documents created outside the system. The system can view documents created by different software programs and can deliver images of its translation to any computer meeting the criteria listed above.

7.6 The system can be personalized by the Construction Manager to automatically send e-mail notices upon issuance of certain documents if such a practice facilitates the User's business needs.

7.7 The system is the product of Building Blok, LLC (www.buildingblok.com) and will be continuously updated.

7.8 The Construction Manager will administer the Building Blok User accounts for this project.

8. DOCUMENTS CREATED INSIDE THE SYSTEM

8.1 The following documents shall be created on templates inside the system.
   a. Transmittals for submittals processed in the system. The transmittals are automatically created by the system when the submittal is uploaded.
   b. Submittal Register showing all of the submittals required of the contract, assigned to each Contractor.
   c. Submittal Log: The CM will maintain submittal log after it is initialized.
   d. RFI (Requests for Information)
   e. Change Orders
   f. RFP (Requests for Proposal)
   g. ASI (Architect's Supplemental Instructions)
   h. Tasks & Memos as determined by the CM
   i. Payment Applications
   j. Closeout Tracking Log

8.2 The following documents may, at each Users option, be created on the system.
   a. Morning & Afternoon Activity Reports generated by the system
   b. E-mails: Contacts that do not have access to the system may be sent information from the system, by the system.

c. Reports of information on the system
d. Project Notices: "Broadcast" messages can be sent to other Users system entry screen.

9. DOCUMENTS CREATED OUTSIDE THE SYSTEM AND DISTRIBUTED BY THE SYSTEM

9.1 The following documents are expected to be created outside the system and distributed through the system. The actual documents may be scanned or electronically attached to the transmittal.

a. Technical Submittals: Shop drawings, product data, testing reports, certifications, installation instructions, operation & maintenance manuals, will be submitted and distributed through the system. The Architect will return all submissions through the system electronically. The Construction Manager will distribute submittals (after Architect's action) electronically. Contractors may download and distribute submittals to their subcontractors and suppliers or elect to print paper copies for distribution, or both.
b. Photographs: Digital photographs and scanned images can be loaded onto the system and shared.
d. Schedule of Values/ Payment Applications: (The "pencil" review of these documents can occur inside the system).
e. Change Orders: (The "pencil" review of these documents can occur inside the system.)
g. Schedules: The schedule document(s) will be available for review on the system.
h. Data created in other software may be uploaded to the system electronically.

10. DOCUMENTS CREATED OUTSIDE THE SYSTEM AND DISTRIBUTED OUTSIDE THE SYSTEM

10.1 The following documents are expected to be created outside the system and distributed outside the system. The actual documents may be scanned or electronically attached to the transmittal.

a. Schedules: The Construction Manager will develop the Master Schedule through Microsoft Project 2003. The schedule will be distributed either through hard copies at meetings or through email.
b. Product samples, color samples, physical samples are still required to be provided per the technical specifications, however, the transmittal documenting the distribution shall be done inside the system and submitted electronically and printed to accompany the actual submission.
c. Meeting minutes will be created using Microsoft Word 2003 and distributed through hard copies at meetings or through email.
d. AIA closeout documents, which require an "original" signature, will created and distributed outside the system.

END OF SECTION

SECTION 01 32 16 - CONSTRUCTION SCHEDULE

1. PRE-BID CONSTRUCTION SCHEDULE

1.1 Time is a critical element of this Project. By entering a bid, the Contractor agrees to adhere to the intermediate Milestone Dates and Dates of Substantial and Final Completion established herein. The Contractor also understands that all work must be performed in an orderly and closely coordinated sequence in order to achieve the specified Milestones and Completion Dates, and the Contractor hereby agrees to perform his work in conformance with the Pre-Bid Construction Schedule established herein, or with the then current and approved Project Construction Schedule as amended from time to time by the Construction Manager.

1.2 The Pre-Bid Construction Schedule includes allowances for time lost due to adverse and abnormal weather conditions, other than floods, hurricanes, tornadoes, lightening and other like acts of God. The Contractor understands and agrees that it shall not be entitled to any extensions of the Contract Time or adjustment to the Contract Sum, except as allowed in the General Conditions of the Contract for Construction. The Contractor further acknowledges that the Work may be required to be performed during the winter season, that conditions during this season may be adverse and abnormal, but that such conditions will not be the basis for an extension of the Contract Time or adjustment to the Contract Sum.

2. SCHEDULING OF THE WORK AFTER AWARD OF CONTRACT

2.1 After award of Contract, or issuance of a Notice to Proceed, the Contractor will meet with the Construction Manager to review the Pre-Bid Construction Schedule, and the overall project plan for construction. Following the above review the Contractor will meet with each subcontractor and supplier to view the detailed plans for performing his Work. Following these meetings and within fourteen (14) days after award of the Contract or issuance of a Notice to Proceed, the Contractor shall prepare and submit for the Construction Manager's approval a Work Schedule providing for the expeditious, timely and practical execution of the Work. The Contractor's Work Schedule shall include activity descriptions and durations for shop drawings, fabrication, delivery and installation. If the Construction Manager so requests, the Contractor shall provide adequate explanation regarding crew sizes, production rates and similar data used to arrive at the durations and sequences.

2.2 The Construction Manager shall review the Contractor's Work Schedule, coordinate it with the separate work by other contractors, the Owner and the Construction Manager, and after coordination, shall incorporate it into the approved Project Construction Schedule. The approved Project Construction Schedule shall be issued to the Contractor and the Contractor shall perform his Work in conformity therewith.

2.3 The Contractor shall submit proposed schedule revisions and obtain the written

approval of the Construction Manager therefore before deviating from the Project Construction Schedule.

2.4 The Construction Manager will incorporate approved schedule revisions into the Project Construction Schedule, and shall otherwise update and revise the Project Construction Schedule as the Construction Manager, at his sole discretion, deems necessary.

2.5 Project schedule attached.

3. ADHERENCE TO THE SCHEDULE

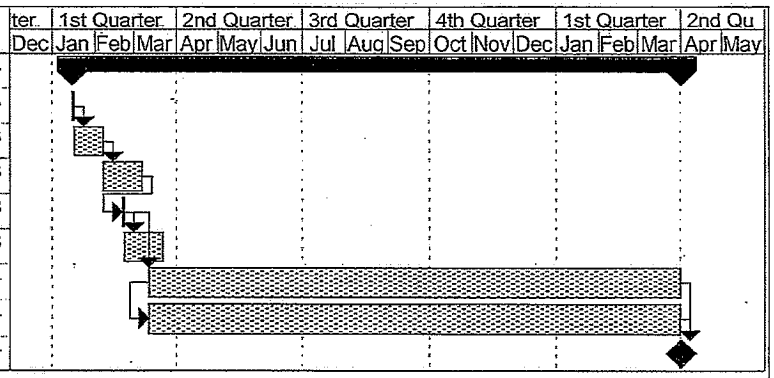
3.1 The Contractor shall start each part of its Work on the date designated for start in the approved Project Construction Schedule unless advised by the Construction Manager. The Contractor shall carry the Work forward expeditiously with adequate forces, equipment and materials, and shall complete each part of his work on or before the date designated in the approved Project Construction Schedule.

3.2 If the Construction Manager determines that the Contractor is behind schedule, the Construction Manager shall have the right to require that the Contractor take steps, at the Contractor's expense, to accelerate its Work. Such steps shall include increases in manpower, equipment and materials and/or overtime as the Construction Manager may deem necessary. If the Contractor fails to comply with the Construction Manager's instructions relating to improved rate of progress, the Contractor may be held in default under the appropriate provisions of the General Conditions of the Contract.

3.3 Each Contractor shall, if directed by the Construction Manager, provide the Construction Manager a 2-week look ahead of anticipated manpower showing the number of men, classification, and anticipated work.

END OF SECTION

ID		Task Name	Duration	Start	Finish
1		**Project Start**	**315 days**	**Wed 1/16/13**	**Tue 4/1/14**
2		Award Contracts	1 day	Wed 1/16/13	Wed 1/16/13
3		Submittals / Shop Drawings	15 days	Thu 1/17/13	Wed 2/6/13
4		Review Shops & Precure Materials	20 days	Thu 2/7/13	Wed 3/6/13
5		Start Construction	1 day	Thu 2/21/13	Thu 2/21/13
6		Install UG electric to Geo-Thermal Vaults	20 days	Fri 2/22/13	Thu 3/21/13
7		Construct Out Buildings	275 days	Tue 3/12/13	Mon 3/31/14
8		Site, paving, Stadiums & Fields	275 days	Tue 3/12/13	Mon 3/31/14
9		Project Substantially Complete	1 day	Tue 4/1/14	Tue 4/1/14



Project: BPG Bid Schedule
Date: Thu 11/8/12

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

SECTION 01 32 19 - SUBMITTAL REGISTER

1. SUBMITTALS/SUBMITTAL REGISTER

1.1 The Contractor shall submit all items listed or specified within the sections of the Specifications included in its Work. Submittals shall include such items as: contractor's, manufacturer's or fabricator's drawings; descriptive literature including, but not limited to, catalog cuts, diagrams, operation charts or curves; test reports; samples, operations and maintenance manuals, including parts lists; certifications; warranties and other required submittals. Submittals pertinent to materials and equipment which are subject to advance approval shall be scheduled and made prior to the acquisition or the delivery thereof.

1.2 The Contractor shall carefully control procurement operations to assure that each individual submittal is made on or before the dates required for timely performance of its Work.

1.3 Within seven (7) days after award of Contract or issuance of Notice to Proceed, the Contractor shall execute and submit to the Construction Manager; An electronic Excel format document identifying the complete submittal register for future project submittals. The register shall contain a list of each item of equipment and material of each type for which fabricator's drawings and/or related descriptive data, test reports, samples, spare parts, operation and maintenance manuals, or other types of submittals required by the Specifications. The order of listing of items on the Register shall conform to the sequence of the items as they occur within the divisions. Drawings of component items forming a system or that are interrelated shall be scheduled to be correlated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time shall be allowed for review and approval and possible resubmittal of any item subject to approval, because no delay damages or time extensions will be allowed for time lost in late submittals or resubmittals. The Construction Manager and Architect/Engineer will review the Submittal Register for approval action. The approved Register will become a part of the Contract and Contractor will be subject to requirements thereof. The Contractor shall revise and/or update the Register monthly to take into account all changes in the Contract. Each such revised edition and/or revision to the Register shall be resubmitted to the Construction Manager. This Register shall be coordinated with related submittals of other Contractors.

2. SAMPLES

2.1 Submit tagged or labeled samples in triplicate, unless another quantity is otherwise specified by the Construction Manager.

2.2 Tags or labels shall be securely affixed and contain as a minimum the following information: Project Name, Contractor's Name, Contract Title and Number, Date, Transmittal Number, Product Manufacturer's or Fabricator's Name and Product Identifier.

END OF SECTION

SECTION 013226 - SUBCONTRACTOR DAILY REPORTS

1. SUBCONTRACTOR DAILY REPORTS

1.1 The Subcontractor shall submit a Daily Report to the Construction Manager on the forms provided covering the following subjects:

1. Work in Progress, including areas where work is being performed, nature of the operations in progress, and the manpower assigned.

2. Extra Work (Time and Material) in progress.

3. Materials Received.

4. Trade labor breakdown including identification of all workers on site and the number of hours (or portions thereof) worked by each.

5. Inspection Checklist (performed daily).

1.2 The Subcontractor shall submit the Daily Report to the Construction Manager by 9:00 AM on the next workday following the workday covered in the Daily Report.

2. DAILY EXTRA WORK REPORT

2.1 The Subcontractor shall submit on the form provided a Daily Extra Work Report on each day he performs authorized Extra Work on a time and material basis.

2.2 A separate Daily Extra Work Report shall be submitted for each separate authorized Extra Work item done on a time and material basis.

2.3 The Subcontractor shall submit his Daily Extra Work Report as an attachment to his Daily Report by 9:00 AM on the next workday following the workday covered in the Daily Extra Work Report.

3. Sample Daily Report

3.1 A sample daily report follows this section for your reference.

END OF SECTION

EDiS COMPANY

CONTRACTOR'S DAILY REPORT

Project Name: _____

Date: _____

Contractor: _____

Contract No. & Description: _____

Weather: _____

Foreman's Name (Print) _____

TRADE	*CLASS	MANPOWER COUNT	TOTAL MAN HOURS	TODAY'S DESCRIPTION / LOCATION OF WORK
	TOTAL			

* *INDICATE: F = FOREMAN; J = JOURNEYMAN; A = APPRENTICE*

Work Status/Work Planned:

Construction Equipment:

Qualified Operator(s)

Deliveries or Materials:

Machinery, tools, material, and equipment to be used:

Inspection of work area, machinery, tools, material, or equipment

The use of any machinery, tool, material, or equipment which is not in compliance with any applicable requirement Is prohibited. Such machine, tool, material or equipment shall either be identified as unsafe by tagging or locking The controls to render them inoperable or shall be physically removed from its place of operation.

Please See Other Side

Below is a general checklist of requirements on this project. Contractors will check off items that pertain to their contract and project tasks. Notify EDiS Field Manager of any issues. This checklist is not meant to be all inclusive. Please refer to additional OSHA regulations for compliance.

House Keeping

- ☐ Material Storage Area's Orderly
- ☐ Trash Containers Available and Emptied daily
- ☐ Fire Hazards
- ☐ Lighting and ventilation
- ☐ Exits and Stair clear passage
- ☐ Walkways, corridors clear passage
- ☐ Daily debris /trash removal
- ☐ _____

Personal Protective Equipment

- ☐ Hard Hats being worn
- ☐ Safety Glasses with side shields being worn
- ☐ Secondary Eye/Face protection
- ☐ Respirators as required
- ☐ Hand protection when needed
- ☐ Ear protection when needed
- ☐ Inspected & Maintained
- ☐ _____

Fire Prevention

- ☐ Fire extinguishers inspected
- ☐ Flammable / Combustibles properly store
- ☐ Approved Fuel cans used and labeled
- ☐ Oxygen / Acetylenes stored properly
- ☐ _____

Electrical

- ☐ GFI in use
- ☐ Three prong insulated extension cords used
- ☐ Extension cords in good condition
- ☐ Lockout / Tag-out program in use
- ☐ _____

Excavations

- ☐ Miss Utility been contacted
- ☐ Properly Barricaded
- ☐ Ladders in use at depths over 4'-0"
- ☐ Ladders every 25'-0" distance
- ☐ Shored, sloped, benched as required
- ☐ Dewatering as needed
- ☐ _____

Ladders

- ☐ Good condition
- ☐ Correct pitch
- ☐ Extends 3'-0" above landing
- ☐ Open and secured / tied off
- ☐ _____

Scaffolds

- ☐ Certified Scaffold Installer
- ☐ Guardrails, toe boards, and planking secured
- ☐ Appropriate signage
- ☐ Adequate cross bracing
- ☐ Secured to building over 25'-0" in height
- ☐ _____

Cranes

- ☐ Rated Load Capacity available in cab
- ☐ Swing Radius barricaded
- ☐ Appropriate certificates / decals / hand signals
- ☐ Daily safety inspection log completed
- ☐ _____

Fall Protection

- ☐ Fall protection plan on file
- ☐ Full harness / shock absorbing lanyard used
- ☐ Anchoring points secured
- ☐ Perimeter barricades
- ☐ Open sided floor protection
- ☐ 6'-0" Tie-off utilized
- ☐ _____

Paperwork

- ☐ MSDS Information
- ☐ Contractors Safety Program
- ☐ Hazardous Communications Training
- ☐ Hazardous Communications Program
- ☐ Contractor Qualified Representation
- ☐ _____

Other

- ☐ _____
- ☐ _____

Foreman / Competent Person:

Print Name_____

SECTION 01 33 00 – SUBMITTAL PROCEDURES

1. GENERAL PROVISIONS

1.1 The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

2. ITEMS TO BE SUBMITTED AT START OF WORK

2.1 Performance/Labor and Material Payment Bond(s): One (1) copy of each bond simultaneously with the signed Agreement. See General Conditions Article 11.4 and Supplementary Conditions.

2.2 Policies or Certificates of Insurance: Two (2) copies simultaneously with the signed Agreement. See General Conditions Article 11 and Supplementary Conditions.

2.3 Contractor's License: Submit a copy of all business licenses required by local and state agencies.

2.4 Contractor's Schedule of Values: Submit for approval within 21 days after the Agreement is signed through the Building Blok Management Program.

2.5 Contractor's Progress Schedule: Two (2) copies for review and reference within 21 days after the Agreement is signed. See General Conditions Article 3.10 and provisions in this Section.

2.6 Submittal Schedule: In Excel electronic format within 21 days after the Agreement is signed. See provisions in this Section.

2.7 Products List: In Excel format for approval within 30 days after the Agreement is signed. See provisions in Section 016200 - MATERIAL AND EQUIPMENT.

3. NON-RESIDENT CONTRACTOR & SUBCONTRACTORS BONDS

3.1 Refer to requirements in Section 011100 - INSTRUCTIONS TO BIDDERS for filing of Surety Bonds with the Division of Revenue.

3.2 If such bonds are required on this project, it will be the responsibility of the Contractor to produce evidence to the Construction Manager that they have been filed, or if not required, to supply a notarized statement that they are not required. This must be done within seven (7) days after award of Contract and in any event before construction starts.

4. RELATED REQUIREMENTS

4.1 See Section 017700 - CONTRACT CLOSE OUT: for submittal requirements for Contract Close out.

5. SUBMITTALS

5.1 All submittals shall be directed to the Construction Manager utilizing the Building Blok Management System.

5.2 Prepare a Submittal's Schedule in Excel electronic format for Shop Drawings, Product Data and Samples. Show:

1. The dates for Contractor's submittals.

2. The dates submittals will be required for Owner-furnished products.

3. The date approved submittals will be required from the Architect.

5.3 Should the Architect or Construction Manager elect to omit any items from the list of items to be reviewed, it shall not relieve the Contractor from compliance with the Contract Documents with regard to that item. In such instance, the Contractor may still elect to have submittals prepared for his own use without review by the Architect or Construction Manager.

6. SHOP DRAWINGS

6.1 Conform to provisions in General Conditions applying to Shop Drawings.

6.2 Present in a clear and thorough manner.

1. Identify details by reference to sheet and details, schedule or room numbers shown on Contract Drawings.

2. Submit through the Building Blok Management System.

7. PRODUCT DATA

7.1 Conform to provisions in General Conditions applying to Product Data.

7.2 Preparation:

1. Clearly mark each copy to specifically identify products or models pertinent to project.

2. Show performance characteristics and capacities.

3. Submit through the Building Blok Management System.

4. Show dimensions and clearances required.

5. Show wiring or piping diagrams and controls.

7.3 Manufacturer's standard schematic drawings and diagrams:

1. Modify drawings and diagrams to delete information which is not applicable to the Work.

2. Supplement standard information to provide information specifically applicable to the Work.

8. SAMPLES

8.1 Conform to provisions in General Conditions applying to Samples.

8.2 Provide samples of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the project, with integrally related parts and attachment devices.

2. Full range of color, texture and pattern.

3. Submit through the Building Blok Management System.

8.3 Field samples and mock-ups; See requirements, if any, in other specification Sections.

9. SUBMITTAL REQUIREMENTS

9.1 Make submittals promptly through the Building Blok System in accordance with published schedule, and in such sequence as to cause no delay in the Work or in the Work of any other contractor.

9.2 Number of submittals required.

1. Shop drawings and Product Data: All submittals through the Building Blok Management System, shop drawings for temporary steel, steel and miscellaneous steel, MEP shop drawings shall also provide one (1) paper copy for approval and ultimate use by the Construction manager for field verification. Any additional copies required by the Contractor shall be made by him.

2. Samples: Submit four (4) each. Submit all data and pictures of samples through the Building Blok Management System. Physical samples to be noted on Building Blok submittal and supplied to Construction manager for processing. When approved it will be returned to the Construction Manager to be retained at the site for reference use.

9.3 Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The Project title and number.
3. Contract identification.
4. The names of the Contractor, Supplier and Manufacturer.
5. Identification of the product, with the specification section number.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the Work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8 inch x 3 inch blank space for Contractor and Architect's stamps.
12. Contractor's stamp, initialed or signed, certifying review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents. Submittals which have not been stamped with this stamp or its approved equivalent will be returned without being reviewed.

9.4 Shop Drawing coordination and interface with work of other Contracts and adjacent work is the responsibility of each individual Contractor.

10. <u>RESUBMISSION REQUIREMENTS</u>

10.1 Make any corrections or changes in the submittals required by the Architect and

resubmit until approved.

10.2 Shop drawings and Product Data:

1. Revise initial drawings or data, and resubmit as specified for the initial submittal.

2. Indicate any changes which have been made other than those requested by the Architect.

10.3 Samples: Submit new samples as required for initial submittal.

11. FINAL DISTRIBUTION OF APPROVED SUBMITTALS

11.1 The Construction Manager will distribute copies of Shop Drawings and Product Data which carry the Architect's stamp through Building Blok to:

1. Contractor that made submittal.

2. Jobsite File.

3. Record Document File.

4. Other Contractors, as required for coordination.

11.2 The Construction Manager will distribute samples as required.

11.3 The Contractor will distribute copies of Shop Drawings and Product Data which carry the Architect's stamp to:

1. Subcontractors.

2. Suppliers.

3. Fabricators.

12. SCHEDULE OF VALUES

12.1 Use AIA Document G703, Continuation Sheet to G702. As formatted on the Building Blok Management System.

13. PROGRESS SCHEDULE

13.1 Prepare schedules in the form of a horizontal bar chart.

1. Provide separate horizontal bar chart for each trade or operation.
2. Horizontal time scale: Identify the first work day of each week.
3. Scale and spacing: To allow space for notations and future revisions.
4. Minimum sheet size 11 inches by 17 inches.

13.2 Format of listings: The chronological order of the start of each item of work.

13.3 Show the complete sequence of construction by activity.

13.4 Show the dates for the beginning, and completion of, each major element of construction such as:

1. Site clearing.
2. Site utilities.
3. Foundation work.
4. Structural framing.
5. Subcontractor work.
6. Equipment installation.

13.5 Show projected percentage of completion for each item as of the first day of each month.

13.6 Update Progress Schedule monthly and submit with Application for Payment and Schedule of values.

13.7 Indicate progress of each activity to date of submission.

13.8 Show changes occurring since previous submission of schedule:

1. Major changes in scope.
2. Activities modified since previous submission.
3. Revised projections of progress and completion.
4. Other identifiable changes.

13.9 Provide a narrative report as needed to define:

1. Problem areas, anticipated delays and the impact of the schedule.
2. Corrective action recommended, and its effect.
3. The effect of changes on schedules of other prime contractors.

13.10 Submit one reproducible transparency.

13.11 After review, distribute copies of the schedule to:

1. Jobsite File.
2. Subcontractors.
3. Architect.
4. Owner.

13.12 Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

END OF SECTION

SECTION 01 35 00 – CONTRACTOR EMPLOYEE BACKGROUND CHECK

1. It is the contractor's responsibility to perform background checks and screen all employees working onsite. The background check must include checking for a previous history of Child Abuse Convictions, Child Molestation Convictions, Felony Convictions, and Drug Convictions within the last 5 years. Any employee with any of these convictions may not enter the job site or school campus. This background check must be completed and screened by the contractor prior to an employee entering the job site. The Construction Manager, The Owner's representative and the Owner have the right to request that the screening data be submitted on a case by case basis.

END OF SECTION

SECTION 013523 - SAFETY PROGRAM

1. GENERAL

1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety activities and programs in connection with the Work.

1.2 Contractor shall be responsible for the safety of its personnel.

1.3 Hard hats and safety glasses must be worn by all personnel on the jobsite, except in contractor's administrative office/trailer. All equipment must comply with OSHA standards. All job site personnel shall wear long pants, shirts (no tank tops) and work boots.

2. SAFETY PROGRAM

2.1 Prior to commencing the Work, the Contractor shall submit to the Construction Manager (1) electronic copy and (1) bound copy of its safety program and one (1) copy of MSDS information in a 2" ringed notebook. One paper copy of the safety program and MSDS will be retained by the Construction Manager in the field office.

2.2 The safety program shall outline those hazards peculiar to the Contractor's Work, and the steps to be taken to eliminate or reduce the risk of injury or loss due to those hazards. The program shall be site specific. Contractor shall implement and enforce its safety program, which is in accordance with all OSHA, Federal, State and local laws.

2.3 Contractor shall designate a qualified Safety Supervisor to implement their safety program. Unless otherwise approved by the Construction Manager, the Safety Supervisor shall be the Contractor's Field Superintendent/Foremen.

2.4 Contractor shall furnish the names and qualifications of the competent persons and qualified persons who may be required for their scope of work by the Contractor's safety procedures, and by federal, state and/or local regulations. Examples include competent persons and/or qualified persons for steel erection, excavation, scaffold erection, confined space entry, crane and rigging operations, annual crane inspections, fall protection including horizontal lifeline systems, etc. See the attached Competent/Qualified Person Designation Log.

2.5 Contractor shall provide written certification showing that all employees have been trained on the Contractor's Safety Program. The written certification record shall contain the name or other identity of the employee trained, the date(s) of the training and the signature of the person who conducted the training or the signature of the employer. If the employer relies on training conducted by another employer or completed prior to the effective date of this section, the certification record shall

include the date the employer determined the prior training was adequate rather than the date of actual training. The employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury. Please forward certification (document) of training for each employee on an EDiS project. The latest training certificate shall be maintained.

2.6 Contractor shall provide certification of training on the following programs, as they pertain to your contract and project tasks: Scaffold, Fall Protection, Crane Operator, Signal Person, Crane Maintenance, Steel Erection Fall Protection, Respiratory Protection, Powder-Actuated Tools, and Motor Vehicles. Certification of training must include: Employee's name, date of training, person conducting the training, topics covered, and a statement that the student has successfully completed the course. This list is not meant to be all inclusive; please refer to OSHA regulations for applicable safety requirements.

2.7 Contractor Daily Reports with Safety Inspection Checklist will be submitted daily to Field Manager, verifying inspection of work area, machinery, equipment and tools.

2.8 Prior to starting work on-site, the Contractor shall arrange with the on-site Field Manager to have their employees complete the EDiS Company Zero Accidents Safety Orientation program.

2.9 Contractor shall hold weekly safety toolbox talks with all of its employees every Monday at 12:30 PM. The Contractor shall designate a responsible, capable person to conduct these meetings. Contractor's safety supervisor or superintendent must submit to the Construction Manager weekly toolbox talks attendance sheets and the topics discussed.

3. <u>SUBSTANCE ABUSE POLICY STATEMENT</u>

The Construction Manager is committed to providing a safe work site environment for its employees and Contractors' employees. The Construction Manager does not condone or permit employees and Contractors' employees to use or be under the influence of drugs or alcohol while they are on any of the Construction Manager's work sites. The Policy is as follows:

3.1 It is a violation of the Construction Manager's policy for employees and Contractors' employees to use, possess, sell, trade, or otherwise engage in the use of illegal drugs and alcohol.

3.2 It is a violation for employees and Contractors' employees to report to work while influenced by illegal drugs or alcohol.

3.3. It is a violation for employees and Contractors' employees to use prescription drugs

illegally (i.e. to use prescription drugs that have not been legally obtained) and to use prescription drugs in a manner other than the prescribed intentions.

3.4 Employees and Contractors' employees who are taking medication, which is prescribed by their physician, are expected to discuss potential side effects with their prescribing physician, as it relates to the work requirements.

Violations of this policy will require disciplinary action. If any employees or Contractors' employees are observed or suspected of being influenced by drugs or alcohol, they will be instructed to stop work and may be required to leave the work site.

4. EXECUTION

4.1 Contractor shall comply with all applicable federal, state and local laws, regulations and orders relating to occupational safety and health, and related procedures, and shall, to the extent permitted by law, indemnify and hold Construction Manager, Owner and Architect, and their respective directors, officers, or agents and employees, harmless from any and all liability, public or private, penalties, contractual or otherwise, losses, damages, costs, attorney's fees, expenses, causes of action, claims or judgments resulting from a claim filed by anyone in connection with the aforementioned acts, or any rule, regulation or order promulgated thereunder, arising out of the Contractor's Work, this Agreement or any subcontract executed in prosecution of the Work. Contractor further agrees in the event of a claim of violation of any such laws, regulations, orders or procedures arising out of or in any way connected with the performance of this agreement, Construction Manager may immediately take whatever action is deemed necessary by Owner and/or Construction Manager to remedy the claim or violation. Any and all costs or expenses paid or incurred by Owner and/or Construction Manager in taking such action shall be borne by Contractor, and may be deducted from any payments due Contractor.

4.2 The Contractor agrees to (1) take all necessary steps to promote safety and health on the job site; (2) cooperate with Owner and/or Construction Manager and other Contractors in preventing and eliminating safety and health hazards: (3) train, instruct and provide adequate supervision to ensure that its employees are aware of, and comply with, applicable Federal and State safety and health laws, standards, regulations and rules, safe healthful work practices and all applicable safety rules, regulations and work practices and procedures (4) not create any hazards or expose any of its employees, employees of the Owner and/or Construction Manager or employees of Contractors to any hazards; and (5) where the Contractor is aware of the existence of a hazard not within its control, notify the Construction Manager of the hazard as well as warn exposed persons to avoid the hazard.

4.3 The Contractor's Superintendent or Safety Supervisor shall immediately, verbally report, and promptly thereafter confirm in writing to the Construction Manager any unsafe conditions or practices that are observed, or violations of job safety which are

not within the Contractor's control.

4.4 Contractors shall immediately, verbally report, and promptly thereafter confirm in writing, to the Construction Manager any unsafe practices or conditions that are observed which are not under the Contractor's control.

4.5 The Contractor's Superintendent or Safety Supervisor shall insure that adequate first aid supplies are available, and that personnel are qualified to administer first aid/CPR, as required by State and/or Federal regulations.

4.6 Contractor shall promptly notify Construction Manager of any personal injury requiring medical treatment of any of the Contractor's employees at the Project site; or of significant damage to property arising in connection with Contractor's performance, as promptly as possible after the occurrence of such injury or damage. Within twenty-four hours of such occurrence, Contractor shall furnish to Construction Manager a complete written report of such injury or damage.

4.7 Contractor certifies that the forgoing terms shall be made applicable to all Contractors' suppliers, materialmen or anyone furnishing labor and/or materials to the site.

4.8 The Contractor shall continue to educate his job Safety Supervisor or Superintendent of their responsibilities, which shall include:

1. Instructing workers and subcontractors under its supervision in safe work practices and work methods at the time they are given work assignments.

2. Ensuring that its workers and subcontractors have and use the proper protective equipment and suitable tools for the job.

3. Continuously checking to see that no unsafe practices or conditions are allowed to exist on any part of his job.

4. Acquainting its workers and subcontractors with all applicable safety requirements and seeing that they are enforced.

5. Setting a good example for his workers.

6. Making a complete investigation of accidents to determine facts necessary to take corrective action.

7. Promptly completing a "Supervisor's Investigation Form" with his Supervisor's assistance and distributing as required. This form will be provided by the Construction Manager.

8. Holding weekly "tool box" safety meetings with his men to:
   a. Discuss observed unsafe work practices or conditions including a review of current Construction Manager safety report.

   b. Review the accident experience of his crew and discuss correction of accident causes.

   c. Encourage safety suggestions from his men.

9. Seeing that prompt medical treatment is administered to an injured employee.

10. Correcting or reporting immediately to job superintendent any observed unsafe conditions, practices or violations of job security.

11. Making all reports required by these Contract Documents to the Construction Manager in a full and timely fashion.

5. SAFETY MEETINGS

5.1 The Contractor's Project Manager or Superintendent shall attend weekly or biweekly supervisory job meetings. The first topic of these meetings will be job site safety. The weekly safety reports will be reviewed and violations must be corrected immediately. Contractors will be encouraged to participate in the on-going jobsite safety.

6. TOOL BOX SAFETY MEETINGS

6.1 The Contractor shall schedule weekly "tool box" safety sessions to be held by his job safety supervisor or superintendent for all of his employees.

6.2 A member of the Contractor's management staff shall periodically attend "tool box" safety sessions to evaluate their effectiveness and offer any appropriate suggestions for improvement.

7. REPORTS

7.1 Contractors shall report all accidents or injuries on a timely basis in accordance with all applicable regulations.

7.2 Contractors shall promptly complete an accident investigation report of all accidents.

7.3 A record of all "tool box" safety sessions shall be made and submitted to the Construction Manager on forms to be provided.

8. SAFETY REPRESENTATIVE

8.1 The Construction Manager may employ the services of a Safety Representativ*e* on the project.

8.2 The Safety Representative *will* visit the job site on a weekly basis to determine if the work is being performed in a safe manner and in accordance with OSHA, State and Local safety regulations. Safety representative is not responsible for observing and documenting all possible safety violations. The Contractor's Safety Representative or Superintendent shall attend job site safety inspections with the Safety Representative on a weekly basis.

8.3 The Safety Representative will file a written report with the Construction Manager at the end of each inspection listing the safety violations observed during the inspection.

8.4 The Construction Manager will distribute the Safety Representative's report to all Contractors. All safety violations must be corrected immediately.

9. RIGHT TO STOP THE WORK DUE TO SAFETY VIOLATIONS

9.1 The Construction Manager, in its sole discretion, may order the Contractor to stop the work due to safety violations under the following circumstances:

1. If the Construction Manager observes the Contractor is violating safety regulations and the Contractor takes no immediate action to correct the violation.

2. If the Contractor has been notified by the Construction Manager in writing that he is in violation of safety regulations and fails to take action to correct the violation within 24 hours of the notice.

9.2 If the Construction Manager directs the Contractor to stop the work due to safety violation, it will be done in accordance with the General Conditions of the Contract. Contractor shall not be permitted an adjustment of the Contract Time or Sum for the days lost to any suspension of work.

9.3 If the Construction Manager or Safety Representative observes Contractor's employee violating this safety program or OSHA Standards in an habitual manner, or creating a serious life safety violation, the Construction Manager or Safety Representative may instruct the Contractor's superintendent or foreman to remove the violator from the work site for failure to comply with the safety program and the contract.

10. EMERGENCY PROCEDURES

10.1 The Construction Manager shall establish a central meeting location for the assembly of all Contractors' employees in the event of a major job site emergency.

10.2 Contractor shall assemble all of their personnel and account for all employees. Contractor must immediately report to the Project Superintendent with the status of their employees.

11. FALL PROTECTION PROCEDURES

11.1 Contractor is responsible, in accordance with federal, state, local laws and regulations including OSHA, to provide and enforce their own site specific fall protection program and equipment. The following fall protection procedures shall be enforced by all Contractors as a minimum standard.

All workers on walking/working surfaces with unprotected sides or edges six feet (6') or higher above the next lower level must be protected from falls by the use of guardrail systems, net systems, fall arrest systems or control access zone programs. It is intended that when fall protection is required, it is required 100% of the time. All contractors are reminded that relevant industry regulations require that contractors comply with the following standards.

1. Workers constructing or working near leading edges must be protected.

2. Workers on the face of formwork or reinforcing steel must be protected at a height of 6 feet (6') or greater.

3. Scaffolds shall be guarded at 6 feet (6') above next lower level.

4. Brick layers performing overhand bricklaying and related work six feet (6') or higher above lower levels must be protected from falls.

5. Roofers must comply with OSHA standards for roof work.

6. The Contractor's controlled access zone plan shall be included in their site-specific safety program and shall be submitted prior to the start of work. Contractors are responsible for assuring programs are OSHA compliant.

7. Guidelines for Residential Construction or any interpretations will not be accepted in lieu of 1926 Standards.

8. Contractors must provide certification per OSHA CFR29 § 1926.503(b) of employee training and retraining on fall protection upon request.

11.2 Contractor shall provide its own fall protection. Fall protection may be provided by guardrail systems, net systems, or personal fall arrest systems. All fall protection systems must comply with OSHA standards.

11.3 Stepladders, exposed to shafts or edges of the building, greater than six feet (6') above

the next lower level, must be tied off or otherwise secured. Employee must wear fall protection, i.e. harness/lanyard.

11.4 The Safety Cable System shall not be altered or removed without a written request submitted to the Project Manager with a copy to the Field Manager. It shall be the responsibility of each and every Contractor that is removing or altering the Safety Cable System to maintain the fall protection safety provided by the safety cable and not leave the area unprotected. Each and every Contractor shall be responsible to re-install the Safety Cable System immediately after work is completed. Each and every Contractor shall be responsible to re-install the Safety Cable System in accordance to OSHA standards.

11.5 Fall protection will be enforced for Structural Steel Erectors.

1. As for a Contractor engaged in structural steel erection, the Contractor is specifically advised that structural steel erectors shall comply with all protection requirements for all work at a height of six feet (6') or greater above the next lower level, 100 percent of the time, by any of the following means.

   a. Standard guardrail system.

   b. Personal Fall Arrest System (PFAS) – full body harness with shock absorbing lanyard. Maximum free fall distance permitted, with lanyard and lanyard attachment shall not exceed six feet (6'). Anchor point must be capable of supporting five thousand pounds. Perimeter guard cables or alignment cables may not be used for anchor points.

   c. Access to work area shall be provided by ladders. There shall be sufficient number of ladders available to reduce the amount of "beam walking." When it is absolutely necessary to traverse a beam, 100% fall protection must be utilized.

   d. Steel erection Contractors must, at all times, be able to certify in writing that each of his employees has been properly trained in both OSHA fall protection standards and the Contractor's site specific project fall protection procedures.

   e. Prior to the erection of the steel, the Contractor shall meet with the Project Manager and Safety Representatives to review and document site specific procedures.

END OF SECTION

Certification of Training Documents to be Submitted with Safety Policy/Program

Provide a certification of training for employees on your safety program.

In addition, Contractor shall provide certification of training on the following programs, as they pertain to your contract and project tasks. Certification of training must include: Employee's name, date of training, person conducting the training, topics covered, and a statement that the student has successfully completed the course. This list is not meant to be all inclusive: please refer to OSHA regulations for applicable safety requirements.

a. ☐ Scaffold: 1926.454

b. ☐ Fall Protection 1926.503

c. ☐ Crane Operator: 1926.1427

d. ☐ Signal person (this is for any persons connecting material or equipment for lifting): 1926.1428

e. ☐ Crane maintenance: 1926.1429

f. ☐ Steel erection fall protection: 1926.761

g. ☐ Respiratory protection (medical clearance and training records complying with 1910.134

h. ☐ Powder-actuated tools: 1926.302

i. ☐ Motor Vehicles (are those vehicles that operate within an off-highway jobsite, not open to public traffic): 1926.21

CONTRACTOR

COMPETENT / QUALIFIED PERSON DESIGNATION LOG

Project: **Field Manager:**

Contract: Contrctor:	Applicable to Subcontractor (yes / no)		Foreman	Competent Person (if not foreman)
Subpart C-General Provisions				
1926-20 General Safety				
Subpart D - Health and Environmental Controls				
1926-53 Ionizing Radiation				
1926-55 Gases, Vapors, Fumes, Dusts, Mists				
1926-57 Ventilation				
1926.59 Hazard Communication				
1926.62 Lead				
Subpart E - Personal Protective Equipment				
1926.101 Hearing				
1926.103 Respirator Protection				
Subpart H - Materials Handling, Storage				
1926.251 Rigging Equipment for Material Handling				
Subpart J - Welding and Cutting				
1926.354 Welding, Cutting and Heating				
Subpart K - Electrical				
1926.404 Wiring Design and Protection				
Subpart L - Scaffolding				
1926.451 Scaffolding				
Subpart M - Fall Protection				
1926.502 Fall Protection Criteria and Practices				
1926.503 Training				
Subpart N - Cranes, Derrick -Redesignated 1926.1501				
Subpart O - Motor Vehicles and Equipment				
1926.601 Motor Vehicles				
Subpart P - Excavations				
1926.651 Specific Excavation Requirements				
1926.652 Requirements to Protective Systems				
Subpart S - Tunnels, Shafts, Caissons				
1926.800 Tunnels, Shafts, Caissons				
1926.803 Compressed Air				
Subpart T - Demolition				
1926.850 Preparatory Operations				
1926.852 Chutes				
1926.859 Mechanical Demolition				
Subpart V - Power Transmission and Distribution				
1926.955 Overhead Lines				

Contract: Contrctor:	Applicable to Subcontractor (yes / no)		Foreman	Competent Person (if not foreman)
Subpart X - Stairways and Ladders				
1926.1053 Ladders				
1926.1060 Training Requirements				
Subpart Z - Toxic and Hazardous Substances				
1926.1101 Asbestos				
1926.1101 thru 1926.1148 Toxic and Hazardous Substances				

I certify that the listed employees are competent persons, as defined and required by specific OSHA standards. They are capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Name (print)

Contractor Signature

Date

PU09, Revised 3/2012

SECTION 01 45 00 - QUALITY CONTROL

1. DESCRIPTION

1.1 Quality control services include inspections and tests performed by independent agencies and governing authorities, as well as by the Contractor. Inspection and testing services are intended to determine compliance of the work with requirements specified. Specific quality control requirements are specified in individual specification sections.

2. RESPONSIBILITIES

2.1 Contractor Responsibilities: Except where indicated as being the Owner's responsibility, quality control services are the Contractor's responsibility, including those specified to be performed by an independent agency and not by the Contractor. The Contractor shall employ and pay an independent agency, testing laboratory or other qualified firm to perform quality control services specified.

1. The Owner will engage and pay for services of an independent agency to perform the inspections and tests that are specified as Owner's responsibilities.

2.2 Retest Responsibility: Where results of inspections or test do not indicate compliance with Contract Documents, retests are the Contractor's responsibility.

2.3 Responsibility for Associated Services: The Contractor shall cooperate with independent agencies performing inspections or test. Provide auxiliary services as are reasonable. Auxiliary services include:

1. Provide access to the Work.

2. Assist taking samples.

3. Deliver samples to test laboratory.

2.4 Coordination: The Contractor and independent test agency shall coordinate the sequence of their activities and shall avoid removing and replacing work to accommodate inspections and test. The Contractor is responsible for scheduling time for inspections and tests.

2.5 Qualifications for Service Agencies: Contractor shall engage only inspection and test service agencies which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories.

2.6 Submittals: Contractor shall submit a certified written report of each test, Inspection

or similar service, in duplicate to the Construction Manager. Contractor shall submit additional copies of each report to any governing authority, when the authority so directs.

2.7 Report Data: Written inspection or test reports shall include:

1. Name of testing agency or test laboratory.

2. Dates and locations of samples, tests or inspections.

3. Names of individual present.

4. Complete inspection of test data.

5. Test results.

6. Interpretations.

7. Recommendations.

2.8 Repair and Protection: Upon completion of inspection or testing, Contractor shall repair damaged work and restore substrates and finishes. Contractor shall comply with requirements for "Cutting and Patching."

2.9 The 2000 IBC code the following testing is code required:

1. Structural tests and special inspections must be conducted by an approved agency (an agency or firm regularly engaged in conducting tests or furnishing inspection services, approved by the authority having jurisdiction.) This means that contractors will no longer be allowed to cast their own test cylinders for example.

2. Continuous special inspection (the full-time observation of work by an approved special inspector who is present until completion of the work) is required for any steel welds and connections. Critical elements may include: all slip critical bolted connections, complete and partial groove welds, multi-pass fillet welds and single pass fillet welds greater than 5/16".

3. Continuous special inspection is required during the placement of all concrete and shotcrete for the proper application techniques with a few exceptions.

4. Periodic special inspection (the part-time observation by an approved special inspector) is required for any steel welds and connections. Critical elements may include: all slip critical bolted connections, complete and partial groove welds, multi-pass fillet welds and single pass fillet welds greater than 5/16".

5. Spray applied fireproofing requires periodic special inspection for the structural member surface conditions, application, thickness, density and bond strength.

6. Based on the classification, occupancy, and design of the structure, the code requires periodic special inspection for placement of masonry units and reinforcing steel and continuous special inspection of grout placement.

END OF SECTION

SECTION 01 51 23 - TEMPORARY HEATING, COOLING AND VENTILATING

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

1. Temporary Electric: Section 01 51 13

2. Temporary Facilities: Section 01 52 00

3. Heating Requirements for Cold Weather Installation and Protection of Materials: Respective specification section for each item of work.

4. Section 01511 Construction IAQ Management.

1.2 DEFINITIONS:

Temporary power to be provided by building contractor for his work.

END OF SECTION

SECTION 01 52 00 - CONSTRUCTION FACILITIES & TEMPORARY CONTROLS

1. GENERAL

1.1 DESCRIPTION

1. Construction Manager and Contractors shall provide all temporary facilities throughout the construction period unless otherwise indicated in the Contract Documents.

2. Construction Manager and Contractors shall pay all costs for providing, maintaining and removing of all temporary facilities unless otherwise indicated in the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

1. Temporary Electric: Section 01 51 13.

2. FACILITIES

2.1 TEMPORARY SANITATION FACILITIES

1. Construction Manager will provide and maintain sanitary facilities for all personnel on the project.

2. The number of sanitary facilities required shall be based on the total number or workers employed on the site and shall be in accordance with the provisions of the applicable code.

3. Construction Manager will maintain sanitary facilities in a sanitary and clean condition at all times.

2.2 TEMPORARY WATER

1. Drinking Water: Contractor shall provide potable water for drinking purposes for all his personnel on the site. He shall furnish disposable drinking cups at water stations. Each water station shall be equipped with a suitable trash container for disposal of the drinking cups.

2. Construction Water: Construction Manager will provide and maintain tap locations for construction water of sufficiently pure and potable quality to avoid deleterious effect on any materials used. Location of construction water tap locations will be determined by the Construction Manager depending on the stage of construction of the incoming water service. Contractor shall provide and maintain all hoses, piping and valves as required for obtaining construction

water from taps provided by the Construction Manager.

2.3 TEMPORARY TELEPHONES

1. Construction Manager will not provide any telephones or fax machines for Contractor's personnel. Each Contractor is responsible for its own phones and fax machines.

2.4 FIELD OFFICE

1. During the period of the Work and until final acceptance of the project, the Construction Manager will provide a weatherproof building for the Construction Manager's Field Project Manager(s) and Superintendent(s). Contractor shall make provisions for its own field office, subject to approval by the Construction Manager.

2.5 FIRE PROTECTION

1. The Construction Manager will provide and maintain portable fire extinguishers on each floor level and building area. Number to conform to applicable codes.

2. Contractor shall provide additional fire extinguishers as required by OSHA regulations for its work.

3. Fire extinguishers shall be Multi-Purpose (ABC) dry chemical, UL labeled.

2.6 ACCESS ROADS AND PARKING AREAS

1. The Construction Manager will provide and maintain access roads on the site.

2. Neither the Construction Manager nor the Owner will provide parking for Contractor's personnel on or about the project site. All parking provisions required for Contractors will be solely the responsibility of the Contractors or their personnel.

2.7 STORAGE AREAS

1. The Construction Manager will assign storage areas on the site. Storage areas are extremely limited and will be assigned in a manner which will best facilitate the work.

2. Contractor shall provide all other storage space required for its work at off-site locations.

3. All combustible or flammable materials must be safely stored in a secured area

in strict accordance with regulations, codes and laws enforced by local, State or Federal agencies, whichsoever is the most stringent.

2.8 FIRST AID STATION

1. The Construction Manager will provide and maintain an unmanned first aid station for all personnel in his jobsite office.

2.9 SECURITY

1. All safety and security measures shall be the responsibility of each Contractor. These measures shall include but are not limited to the provision of secured storage for tools, construction equipment, and materials and equipment scheduled for installation in the building.

2.10 BENCH MARKS AND BASELINE

1. The Construction Manager will lay out and establish and maintain bench marks and baselines.

2. The Contractor shall lay out his own work and shall be responsible for the accuracy of same.

3. Contractor shall check grades, lines, levels and dimensions as shown on the drawings and shall promptly report errors or inconsistencies in same to the Construction Manager before Work proceeds.

4. The Contractor is responsible for damaging or altering the bench marks and baselines established by the Construction Manager and shall bear the costs of replacing same.

2.11 FIELD OFFICE AND STORAGE TRAILERS

1. Contractor shall provide and maintain its own field office and storage trailers as required.

2. Contractor shall provide temporary heat and power for its field office and storage trailer.

3. Contractor's field offices and storage trailers shall be located as directed by the Construction Manager.

2.12 PROJECT SIGN

1. The Construction Manager will provide a Project Sign naming the major

participants, as determined by the Owner.

2.13 TRASH DISPOSAL

1. Each Contractor shall be responsible for clean up and depositing its common trash in the dumpsters provided by the Construction Manager.

2. The Construction Manager will not provide a trash chute.

3. The Construction Manager will provide dumpsters, and will arrange for disposal of common, non-hazardous, work-related trash deposited in these dumpsters.

2.14 HOISTING

1. Contractor shall provide its own materials hoists and cranes. No personnel hoist will be provided.

2.15 SCAFFOLDING AND WORKING PLATFORMS

1. No scaffolding shall be provided by the Construction Manager. Each Contractor shall provide all scaffolding required to perform its Work.

2.16 SAFETY BARRICADES AND RAILINGS

1. The Structural Contractor shall provide barricades around elevator, stair, shaft and cut openings in floors and roofs, and edges of floors and roofs. All barricades shall at a minimum, be constructed of two runs of 1/2" diameter wire rope cable with adequate turn-buckle and eyes such that no more than 60' of cable need be loosened or removed at any given location for access. All cables shall be installed such that no more than 3" of deflection of the cable is achieved at any point between supports. The methods and materials used in barricading shall be in accordance with OSHA and local code regulations, and shall be approved by the Construction Manager prior to installation. Barricades will be installed immediately after the installation of the floor slab on any level or part of a level on the Building. Until a level has been fully barricaded, the Structural Contractor will be responsible for maintenance of the barricades. After a level has been fully barricaded, the Construction Manager will assume maintenance of the barricades until a subsequent contractor requires the barricades to be removed in order to accomplish his work, at which time that contractor will assume maintenance of the barricades.

2. After the barricades are no longer needed, the Construction Manager will remove the barricades from the site. The Construction Manager will determine the location and scheduling of barriers to be removed.

3. Contractor shall provide for its own barricades at all other trenches, excavations, and locations not specifically identified in Paragraph 1 above.

4. Contractors who remove barricades shall be responsible for replacing them. If, after proper notification, in writing, from the Construction Manager the responsible Contractor does not correct his deficiencies in safety barricade placement, the Construction Manager reserves the right to undertake this work and backcharge the responsible Contractor(s).

5. During the execution of his work, Contractor will provide daily maintenance of, and upon completion of same, restore all barricades in a manner acceptable to prevailing safety standards enforced by local, State or Federal ordinance, whichsoever is most stringent. The intent is to leave no floor penetration or perimeter opening in an unsafe condition.

6. The Construction Manager shall arrange for temporary ladders required for access to each of the floor levels after the completion of floor slab work, and until the final stairs are ready for use.

2.17 PUMPING AND DRAINAGE

1. Contractor shall provide its own pumping and drainage.

2. When an area is released by one Contractor to another, the Contractor releasing an area shall be responsible for leaving it in a drained condition. The incoming Contractor shall assume responsibility for drainage on the day that he is scheduled to start work in the area. If the incoming Contractor is late in starting work, he shall assume responsibility for pumping and drainage arising as a result.

2.18 TEMPORARY BUILDING ENCLOSURES

N/A

2.19 TEMPORARY POWER AND LIGHTING

1. Provide own power source if required.

2. Contractor shall provide its own additional temporary lighting of sufficient lighting levels to properly install his work.

2.20 TEMPORARY HEAT

1. To be provided by General Carpentry Contractor if required for his work.

2.21 PROTECTION OF ADJACENT MATERIALS

1. Contractor shall protect adjacent materials and finishes from damage as a result of its work.

2.22 CLEAN UP

1. Contractor shall arrange for clean up and removal of debris resulting from its operations, and shall dispose of debris in accordance with the provisions of Paragraph 2.13 above. Clean up shall be scheduled on a continual basis to ensure that building, grounds and public properties are maintained free from accumulations of waste materials and trash, but in any case not less than once a week.

2. The Contractor will ensure that all waste materials that are combustible or flammable will be removed from the building at the end of each work day. All trash considered to be edible by rodent will be disposed of in metal containers and removed by the end of the work day.

3. At completion of its Work, each Contractor shall remove waste materials, rubbish, tools, equipment, and clean up all exposed surfaces in preparation for final cleaning.

4. If, after notification in writing from the Construction Manager, the Contractor does not correct its deficiencies in housekeeping within twenty four (24) hours, the Construction Manager reserves the right to undertake the Work and to backcharge the Contractor.

5. Final clean up prior to Owner occupancy shall be arranged for by the Construction Manager.

2.23 DUST PROTECTION

1. Contractor shall erect and maintain dust proof protection whenever its operations will produce dust and dirt that might filter through the building into occupied or finished areas. Contractor shall be responsible for all cleaning required due to its failure to provide such dust protection.

2.24 PROTECTION OF EXISTING CONSTRUCTION

1. Contractor shall be responsible for all damage that it may cause to materials and equipment stored or installed by other Contractors.

2.25 OTHER

1. Contractor shall provide any other Temporary Facilities and services that it requires and which are not specifically identified above.

3. PERMITS

3.1 The Construction Manager will obtain the Building Permit. All other permits are to be obtained and paid for by the Contractor requiring them.

4. EXECUTION

4.1 GENERAL

1. Contractor shall install all temporary facilities in accordance with applicable codes.

2. Contractor shall maintain temporary facilities for which it is responsible throughout the construction period.

3. Contractor shall remove all temporary facilities for which it is responsible when they are no longer required or when the Construction Manager directs the removal of same.

4. Contractor shall repair all damage to the Project Site caused by the installation of its temporary facilities.

END OF SECTION

SECTION 01 62 00 - MATERIAL AND EQUIPMENT

1. GENERAL CONDITIONS

1.1 The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate apply to the Work specified in this Section.

1.2 Where work is to be executed under Separate Prime Contracts, the provisions of this Section apply to each Contract.

2. REQUIREMENTS INCLUDED

2.1 All materials and equipment incorporated into the Work shall:

1. be new;

2. conform to applicable specifications and standards; and

3. comply with size, make, type and quality specified, or as specifically approved in writing by the Architect.

2.2 Manufactured and Fabricated Products shall conform to the following requirements:

1. Designed, fabricated and assembled in accord with the best engineering and shop practices.

2. Manufactured like parts of duplicate units to standard sizes and gauges, to be interchangeable.

3. Two or more items of the same kind shall be identical, by the same manufacturer.

4. Products shall be suitable for service conditions.

5. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

2.3 Contractor shall not use materials or equipment for any purpose other than that for which it is designated or is specified.

2.4 Materials removed form existing structures shall not be reused in the completed work unless specifically indicated or specified.

2.5 For materials and equipment specifically indicated or specified to be reused in the

Work:

1. Contractor shall use special care on removal, handling storage and reinstallation, to assure proper function in the completed Work.

2. Arrange for transportation, storage and handling of products which require off-site storage, restoration or renovation. Pay all costs for such work.

3. MANUFACTURER'S INSTRUCTIONS

3.1 When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, Contractor shall obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Construction Manager.

1. Maintain one set of complete instructions at the job site during installation and until completion.

3.2 Contractor shall handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, Contractor shall consult with Construction Manager for further instructions.

2. Contractor shall perform work in accord with manufacturer's instructions. Contractor shall not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

4. TRANSPORTATION AND HANDLING

4.1 Contractor shall arrange deliveries of Products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Contractor shall immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that Products are properly protected and undamaged.

4.2 Contractor shall provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

5. STORAGE AND PROTECTION

5.1 Contractor shall store Products in accord with manufacturer's instructions, with seals and labels intact and legible.

1. Contractor shall store Products subject to damage by the elements in weathertight enclosures.

2. Contractor shall maintain temperature and humidity within the ranges required by manufacture's instructions.

5.2 Exterior Storage

1. Contractor shall store fabricated Products above the ground, on blocking or skids, to prevent soiling or staining. Cover Products which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

2. Contractor shall store loose granular materials in a well-drained area on soiled surfaces to prevent mixing with foreign matter.

5.3 Contractor shall arrange storage in a manner to provide easy access for inspection. Contractor shall make periodic inspections of stored Products to assure that Products are maintained under specified conditions, and free from damage or deterioration.

5.4 Contractor shall store flammable materials so as to prevent contact with flames and fire. Conform with manufacturer's recommendations and local laws. Pay particular attention to storage of:

1. Roof insulation.

2. Roofing materials, including solvents.

3. Paint materials.

4. Cleaning and other solvents.

5. Fuels.

5.5 Protection after Installation:

1. Contractor shall provide substantial coverings as necessary to protect installed Products from damage from traffic and subsequent construction operations. Remove when no longer needed.

6. SUBSTITUTIONS AND PRODUCT OPTIONS

6.1 Product List.

1. Within 30 days after Contract Date, Contractor shall submit to Construction Manager a complete list of major products proposed to be used, with the name of the manufacturer and the installing Contractor.

6.2 Contractor's Options.

1. For Products specified only by reference standard, Contractor shall select any Product meeting that standard.

2. For Products specified by naming several Products or manufacturers, Contractor shall select any one of the Products or manufacturers named which complies with the specifications.

3. For Products specified by naming one or more Products or manufacturers and "or equal", Bidders must, during the bidding period, submit a request for substitutions for any Product or manufacturer not specifically named. See provisions in Paragraph 1.6.3.

4. For Products specified by naming only one Product and manufacturer, there is no option; and Contractor shall provide the precise Product specified.

6.3 Substitutions.

1. Until a date no later than seven (7) days before the date Bids are due, Architect will consider written requests from bidders for substitution of Products. The contractor will submit any substitution requests to the Construction Manager for transmittal to the Architect. The architect will review requests and will notify Bidders in an Addendum if the requested substitution is acceptable.

2. Should the Bidder desire a substitution, it shall submit a separate request for each Product, supported with complete data, with drawings and samples as appropriate, including:

    1. Comparison of the qualities of the proposed substitution with that specified.

    2. Changes required in other elements of the Work because of the substitution.

    3. Effect on the construction schedule.

    4. Cost data comparing the proposed substitution with the Product specified.

5. Any required license fees or royalties.

6. Availability of maintenance service, and source of replacement materials.

3. Architect, in its sole discretion, shall be the judge of the acceptability of the proposed substitution.

4. A request for a substitution constitutes a representation that Bidder:

    1. has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified;

    2. will provide the same warranties or bonds for the substitution as for the Product specified;

    3. will coordinate the installation of an accepted substitution into the Work, and make such other changes as may be required to make the Work complete in all respects; and

    4. waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

6.4 Architect will review requests for substitutions with reasonable promptness, and notify Bidders, in writing, through the Construction Manager, of the decision to accept or reject the requested substitution. Any decision to accept a substitution must be confirmed in an Addendum issued during the bidding period in order to be valid. Oral approvals will not be binding.

END OF SECTION

SECTION 01 71 23 - FIELD ENGINEERING

1. GENERAL PROVISIONS

1.1 The general provisions of the Contract, including the Conditions of the Contract, (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 The provisions of the section apply to all contracts.

2. SURVEY

2.1 The Owner has had a site survey prepared by Becker Morgan Group. This information has been included in this Bid Pac.

3. CONSTRUCTION MANAGER

3.1 The Construction Manager will establish a bench mark and base line from which structures and grades shall be laid out by Contractors as designated in this section. The total extent of this layout is shown on the site drawings. One bench elevation shall be provided.

END OF SECTION

SECTION 01 73 29 - CUTTING AND PATCHING

1. GENERAL

1.1 Definition: "Cutting and Patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition.

1.2 Refer to Other Sections of these specifications for specific cutting and patching requirements and limitations applicable to individual units of work.

1.3 Structural Work: Do not cut and patch structural work in a manner resulting in a reduction of load carrying capacity or load deflection ratio. Submit proposal and request and obtain Architect's/Engineer's approval before proceeding with cut and patch of structural work.

1.4 Operational/Safety Limitations: Do not cut and patch operational elements and safety components in a manner resulting in decreased performance, shortened useful life, or increased maintenance. Submit proposals and requests and obtain Architect's/Engineer's approval before proceeding with cut and patches of structural work.

1.5 Visual/Quality Limitations: Do not cut and patch work exposed to view (exterior and interior) in manner resulting in noticeable reduction of aesthetic qualities and similar qualities, as judged by Architect/Engineer.

1. Engage the original Installer/Fabricator, or (if not available) an acceptable equivalent entity, to cut and patch the following categories of exposed work but not limited to
2. Exterior wall materials, ie., curtain wall
3. Finish floor materials, ie., substrate, carpet, ceramic tile
4. Walls
5. Ceilings

1.6 Limitation on Approvals: Architect's/Engineer's approval to proceed with cutting and patching does not waive right to later acquire removal/replacement of work found to be cut and patched in an unsatisfactory manner, as judged by Architect/Engineer.

2. MATERIALS

2.1 General: Use materials for cutting and patching that are identical to existing materials. If identical materials are not available, or cannot be used, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials for cutting and patching that will result in equal or better

performance characteristics.

3. EXECUTION

3.1 Inspection: Before cutting, examine surfaces to be cut and patched and conditions under which the work is to be performed. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the work.

3.2 Temporary Support: To prevent failure provide temporary support of work to be cut.

3.3 Protection: Protect other work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations.

1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

2. Take precautions not to cut existing pipe, conduit or duct serving the building but scheduled to be relocated until provisions have been made to bypass them.

3.4 Cutting: Cut the work using methods that are least likely to damage work to be retained or adjoining work. Where possible review proposed procedures with the original installer; comply with original installer's recommendations.

1. Where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut through concrete and masonry using a cutting machine such as a carborundum saw or core drill. Cut holes and slots neatly to size required with minimum disturbance of adjacent work. To avoid marring existing finished surfaces, cut and drill from the exposed or finished side into concealed surfaces. Temporarily cover openings when not in use.

3.5 Patching: Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.

1. Restore exposed finishes of patched areas and where necessary extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and finishing.

END OF SECTION

SECTION 01 77 00 - CONTRACT CLOSE OUT

1. DESCRIPTION OF REQUIREMENTS

1.1 Provisions of this section apply to the procedural requirements for the actual close out of the Work, not to the administrative matters such as final payment or the change over of insurance. Close out requirements relate to both substantial and final completion of the Work; they also apply to individual portions of completed work as well as the Total work. Specific requirements contained in other sections have precedence over the general requirements contained in this section.

1.2 Closeout documents will be submitted through the Building Blok Management Program.

2. PROCEDURES AT SUBSTANTIAL COMPLETION

2.1 Prerequisites: Contractor shall comply with the General Conditions and complete the following before requesting inspection of the Work, or a designated portion of the Work, for certification of substantial completion:

1. submit executed warranties, workmanship bonds, maintenance agreements, inspection certificates, releases of liens, tax certification and similar required documentation for specific units of work, and documents needed to enable Owner's unrestricted occupancy and use;

2. submit record documentation, maintenance manuals, tools, spare parts, keys and similar operational items;

3. complete instructions of Owner's operating personnel, and start up of systems; and

4. complete final cleaning and remove temporary facilities and tools.

2.2 Inspection Procedures: Upon receipt of Contractor's request, Architect/Engineer will either proceed with inspection or advise Construction Manger of prerequisites not fulfilled. Following initial inspection, Architect/Engineer will either prepare certificate of substantial completion, or advise Construction Manager of work which must be performed prior to issuance of certificate. The Architect/Engineer will repeat the inspection when requested and assure that the work has been substantially completed. Results of the completed inspection will form the initial "punch list" for final acceptance.

2.3 Punch List Procedures: Each Contractor shall be given a copy of the punch list with its appropriate work identified. Each Contractor shall be given 9 (nine) calendar

work days to complete their punch list work. On the 10th day or as determined by the Construction Manager the Construction Manager shall employ other Contractors, as required, to complete any incomplete punch list work and retain from the appropriate Contractors retainage all costs incurred.

3. PROCEDURES AT FINAL ACCEPTANCE

3.1 Reinspection Procedure: The Architect/Engineer will reinspect the Work upon receipt of the Contractor's notice that, except for those items whose completion has been delayed due to circumstances that are acceptable to the Architect/Engineer, the Work has been completed, including punch list items from earlier inspections. Upon completion of reinspection, the Architect/Engineer will either recommend final acceptance and final payment, or will advise the Contractor of work not completed or obligations not fulfilled as required for final acceptance. If necessary, this procedure will be repeated.

4. RECORD DOCUMENTATION

4.1 Record Drawings: Contractor shall maintain a complete set of either blue or black line prints of the contract documents and shop drawings for record mark up purposes throughout the Contract Time. Contractor shall mark up these drawings during the course of the Work to show both changes and the actual installation, in sufficient detail to form a complete record for Owner's purposes giving particular attention to work that will be concealed and difficult to measure and record at a later date, and Work which may require servicing or replacement during the life of the project. Require the entities marking prints to sign and date each mark up. Bind prints into manageable sets, with durable paper cover, appropriately labeled.

4.2 Maintenance Manual: Contractor shall provide 3-ring vinyl covered binders containing required maintenance manuals, properly identified and indexed and including operating and maintenance instructions extended to cover emergencies, spare parts, warranties, inspection procedures, diagrams, safety, security, and similar appropriate data for each system of equipment item.

4.3 State Tax Certification: Contractor shall provide recent Delaware State Tax Certification form as issued by State of Delaware, Department of Finance, Division of Revenue, Carvel State Office Building, 820 N. French Street, Wilmington, Delaware 19801.

5. GENERAL CLOSE OUT REQUIREMENTS

5.1 Operator Instruction: Contractor shall require each Installer of systems requiring continued operation and maintenance by Owner's operating personnel, to provide on location instruction to Owner's personnel, sufficient to ensure safe, secure, efficient,

non-failing utilization and operation of systems. Contractor shall provide instructions for the following categories of work:

1. Mechanical/electrical/electronic systems (not limited to work of Division 15 and 16).

2. Roofing, flashing, joint sealers.

3. Floor finishes.

6. FINAL CLEANING

6.1 At the time of project close out Contractor shall clean or reclean the Work to the condition expected from a normal, commercial building cleaning and maintenance program. Complete the following cleaning operations before requesting the Architect/Engineer's inspection for certification of substantial completion:

1. Remove non-permanent protections and labels.

2. Polish glass.

3. Clean exposed finishes.

4. Touch up minor finish damage.

5. Clean or replace mechanical systems filters.

6. Remove debris.

7. Broom clean unoccupied spaces.

8. Sanitize plumbing and food service facilities.

9. Clean light fixtures and replace burned out lamps.

10. Sweep and wash paved areas.

11. Police yards and grounds.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous construction waste.
   2. Recycling nonhazardous construction waste.
   3. Disposing of nonhazardous construction waste.

B. Related Requirements:
   1. Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.
   2. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.03 PERFORMANCE REQUIREMENTS

A. General: Achieve minimum end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:
   1. Construction Waste:
      a. Masonry and CMU.
      b. Lumber.
      c. Wood sheet materials.
      d. Wood trim.
      e. Metals.
      f. Roofing.
      g. Insulation.
      h. Carpet and pad.
      i. Gypsum board.
      j. Piping.
      k. Electrical conduit.

l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
   1) Paper.
   2) Cardboard.
   3) Boxes.
   4) Plastic sheet and film.
   5) Polystyrene packaging.
   6) Wood crates.
   7) Plastic pails.

1.04 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.05 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste salvaged, both estimated and actual in tons.
   5. Quantity of waste recycled, both estimated and actual in tons.
   6. Total quantity of waste recovered (salvaged plus recycled) in tons.
   7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. LEED Submittal: LEED letter template for Credit MR 2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

H. Qualification Data: For waste management coordinator and refrigerant recovery technician.

I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.06 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.

1.07 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Track and keep a summary log of all construction waste generated by type, the quantities of each type that were diverted and landfilled, and the total percentage of waste diverted from landfill disposal. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan. Plan shall, at a minimum, identify the diversion goals, relevant construction debris and materials to be diverted, implementation protocols, and parties responsible for implementing the plan.

B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
   1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
   2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
   3. Salvaged Materials for Donation: For materials that will be donated to individuals

and organizations, include list of their names, addresses, and telephone numbers.

4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
   1. Distribute waste management plan to everyone concerned within three days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.03 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.04 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 81 13

SUSTAINABLE DESIGN REQUIREMENTS LEED FOR SCHOOLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to pursue LEED Silver certification based on USGBC's "LEED 2009 for Schools New Construction and Major Renovations."
   1. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
   2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
   3. A copy of the LEED Project checklist is attached at the end of this Section for information only.

B. Related Requirements:
   1. Divisions 01 through 49 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

1.02 DEFINITIONS

A. Agrifiber Board: A composite panel product derived from recovered agricultural waste fiber from sources such as cereal straw, sugarcane bagasse, sunflower husk, walnut shells, coconut husks, and agricultural prunings. The raw fibers are processed and mixed with resins to produce panel products with characteristics similar to those derived from wood fiber. The following conditions describe which products must comply with requirements:
   1. The product is inside the building's waterproofing system.
   2. Composite components used in assemblies are to be included (e.g., door cores, panel substrates).
   3. The product is part of the base building systems.

B. Certified Wood:
   1. Chain-of-Custody (COC): A tracking procedure for a product from the point of harvest or extraction to its end use, including all successive stages of processing, transformation, manufacturing, and distribution.
   2. Chain-of-Custody Certification: Certification awarded to companies that produce, sell, promote, or trade forest products after audits verify proper accounting of material flows and proper use of the Forest Stewardship Council name and logo. The COC certificate number is listed on invoices for nonlabeled products to document that an entity has followed FSC guidelines for product accounting.

C. Composite Wood: Wood or plant particles or fibers bonded together by a synthetic resin or binder. Examples include plywood, particleboard, oriented-strand board (OSB), medium-density fiberboard (MDF), and composite door cores. The following conditions describe which products must comply with the credit requirements:
   1. The product is inside the buildings waterproofing system.

2. Composite wood components used in assemblies are included (e.g., door cores, panel substrates, plywood sections of I-beams).
3. The product is part of the base building systems.

D. Construction Indoor Air Quality Management Plan: A plan that outlines measures to minimize contamination in a specific Project building during construction and describes procedures to flush the building of contaminant prior to occupancy.

E. Construction and Demolition Debris: Waste and recyclables generated from construction and from the renovation, demolition, or deconstruction of preexisting structures. It does not include land-clearing debris, such as soil, vegetation, and rocks.

F. Contaminants: Unwanted airborne elements that may reduce air quality. (ASHRAE 62.1-2007)

G. Indoor Air Quality (IAQ): The nature of air inside a building that affects the health and well-being of building occupants. It is considered acceptable when there are known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction. (ASHRAE 62.1-2004).

H. Minimum Efficiency Reporting Value (MERV): A filter rating established by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE 52.2-1999, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size). MERV categories range from 1 (very low efficiency) to 16 (very high).

I. Rapidly Renewable Materials: Agricultural products, both fiber and animal, that take 10 years or less to grow or raise and can be harvested in a sustainable fashion.

J. Recycled Content: The proportion, by mass, of preconsumer or postconsumer recycled material in a product (ISO 14021).
   1. Postconsumer Recycled Content: The percentage of material in a product that was consumer waste. The recycled material was generated by household, commercial, industrial, or institutional end-users and can no longer be used for its intended purpose. It includes returns of materials from the distribution chain (ISO 14021). Examples include construction and demolition debris, materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking), and landscaping waste (e.g., leaves, grass clippings, tree trimmings).
   2. Preconsumer Recycled Content: Formerly known as “postindustrial content”, this is the percentage of material in a product that is recycled from manufacturing waste. Examples include planer shavings, sawdust, bagasse, walnut shells, culls, trimmed materials, overissue publications, and obsolete inventories. Excluded are rework, regrind, or scrap materials capable of being reclaimed within the same process that generated them (ISO 14021).

K. Recycling: The collection, reprocessing, marketing, and use of materials that were diverted or recovered from the solid waste stream.

L. Refurbished Materials: Products that could have been disposed of as solid waste. These products have completed their life cycle as consumer items and are then refurbished for reuse without substantial alteration of their form. Refurbishing includes renovating, repairing, restoring, or generally improving the appearance, performance, quality, functionality, or value of a product.

M. Regional Materials:

1. Regionally Extracted Materials: Raw materials taken from within a 500-mile radius of the Project Site.
2. Regionally Manufactured Materials: Materials assembled as finished products within a 500-mile radius of the Project Site
3. Remanufactured Materials: Items that are made into other products. One example is concrete that is crushed and used as subbase.

N. Reuse: The return of materials to active use in the same or a related capacity as their original use, thus extending the lifetime of materials that would otherwise be discarded.

O. Salvaged Materials/Reused Materials: Construction materials recovered from existing buildings or construction sites and reused. Common salvaged materials include structural beams and posts, flooring, doors, cabinetry, brick, and decorative items.

P. Urea-Formaldehyde: A combination of urea and formaldehyde that is used in some glues and may emit formaldehyde at room temperature.

Q. Verification: The range of checks and tests carried out to determine whether components, subsystems, systems, and interfaces between systems operate in accordance with the Contract Documents.

R. Volatile Organic Compounds (VOCs): Carbon compounds that participate in atmospheric photochemical reactions (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate). The compounds vaporize at normal room temperatures.

1.03 REFERENCE STANDARDS

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   1. ASHRAE 52.2-1999: Method of Testing General Ventilation Air-Conditioning Devices for Removal Efficiency by Particle Size.
   2. ASHRAE 55: Thermal Environmental Conditions for Human Occupancy. Atlanta: ASHRAE, 2004.
   3. ASHRAE 62.1: Ventilation for Acceptable Indoor Air Quality, 2004.
   4. ASHRAE Guideline 1: The HVAC Commissioning Process, 1996.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
   1. ASHRAE/IESNA 90.1: Energy Standard for Buildings except Low-Rise Residential Buildings. Atlanta/New York: ASHRAE/IESNA, 2004.

C. California Department of Health Services:
   1. Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.
      a. Available in PDF at www.cal-iaq.org/VOC/

D. Carpet and Rug Institute; http://www.carpet-rug.org/:
   1. CRI 104-2002: Standard for Installation Specification of Commercial Carpet:
      a. Green Label (testing program).
      b. Green Label Plus (testing program).

E. Code of Federal Regulations:
   1. 40 CFR 59, Subpart D-2001: National Volatile Organic Compound Emission Standard for Architectural Coatings.

F. Efficiency Valuation Organization (P.O. Box 23363, Washington, DC 20026-3363):

1. International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction, 2003.
   a. Available in PDF at www.ipmvp,org.

G. Environmental Protection Agency:
   1. Compendium of Methods for the Determination of Air Pollutants in Indoor Air. April 1990.
   2. Document No. 832R92005: Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices. Washington, DC: EPA, 1992. Available from Department of Commerce, National Technical Information Service, www.ntis.gov; Ch. 3 is available in PDF at www.epa.gov/npdes/pubs/chap03_conguide.pdf
   3. Document No. 840R92002: Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. 1993. (Available from Department of Commerce, National Technical Information Service, www.ntis.gov

H. Environmental Protection Agency:
   1. FSC STD-01-001-2004: FSC Principals and Criteria for Stewardship; available in PDF at www.fsc.org.

I. Green Seal; http://www.greenseal.org:
   1. Green Seal GC-03: Green Seal Environmental Standard for Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
   2. Green Seal GS-11: Green Seal Environmental Standard for Paints and Coatings, 1st Edition, May 20, 1993.
   3. Green Seal GS-36: Green Seal Environmental Standard for Commercial Adhesives, 1st Edition, October 9, 2000.

J. Public Technology Institute/U.S. Green Building Council:
   1. Sustainable Building Technical Manual - Green Building Design, Construction, and Operation. Washington, DC: PTI/USGBC, 1996. (1301 Pennsylvania Ave. NW, Washington, DC 20004; 202-626-2412; available to members of the USGBC in PDF at www.usgbc.org

K. Resilient Floor Covering Institute; http://www.rfci.com:
   1. FloorScore Program; http://www.rfci.com/int_FloorScore.htm.

L. Sheet Metal and Air Conditioning Contractors' National Association:
   1. SMACNA IAQ Guideline for Occupied Buildings under Construction. 1995.

M. South Coast Air Quality Management District; http://www.aqmd.gov/:
   1. Rule 1113 - Architectural Coatings.
   2. Rule 1168 - Adhesive and Sealant Applications.

N. U.S. Green Building Council; http://www.usgbc.org/:
   1. LEED Reference Guide for Green Building Design and Construction, Schools 2009 Edition .

1.04 ADMINISRATIVE SUBMITTALS

A. Respond to questions and requests from Architect, LEED requirements coordinator (Project LEED AP), and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

1.05 ACTION SUBMITTALS

A. General: Submit additional LEED submittals required by other Specification Sections.

B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

C. LEED Documentation Submittals:
   1. Credit EA 5 “Measurement and Verification”: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over a period of time of not less than one year of postconstruction occupancy.
      a. Credit MR 2 “Construction Waste Management”: Comply with Section 01 74 19 "Construction Waste Management and Disposal."
      b. Credit MR 4 “Recycled Content”:
         1) List of product names, manufacturers' names, costs, percentage postconsumer content, and percentage preconsumer content.
         2) Cutsheets or manufacturer's letters to document the listed products' recycled content.
         3) List of actual materials costs, excluding labor and equipment, for CSI MasterFormat 2004 Edition Divisions 02-10 only.
      c. Credit MR 5 “Regional Materials”:
         1) List of product purchases manufactured, extracted, or harvested regionally.
         2) List of manufacturers' names, product costs, distances between the Project and manufacturer, and distances between the Project and the extraction site.
         3) Cutsheets that document material origin and manufacture within a 500-mile radius of the Project Site.
         4) List of actual materials costs, excluding labor and equipment, for CSI MasterFormat 2004 Edition Divisions 02-10 only.
      d. Credit MR 6 “Rapidly Renewable Materials”:
         1) List of rapidly renewable product purchases.
         2) List of manufacturers' names, materials costs, the percentage of each product that is rapidly renewable criteria (by weight), and each compliant value.
         3) Cutsheets that document rapidly renewable criteria.
         4) List of actual materials costs, excluding labor and equipment, for CSI MasterFormat 2004 Edition Divisions 02-10 only.
      e. Credit MR 7 “Certified Wood”: Product data and chain-of-custody (COC) certificates for products containing wood-based materials and products that are certified in accordance with the Forest Stewardship Council's (FSC's) principles and criteria and that are permanently installed in the Project.
         1) Each wood product must be identified on a line item basis.
         2) FSC products must be identified as such on a line item basis.
         3) The dollar value of each line item must be shown.
         4) Vendor invoices for each certified word product. The vendor's COC certificate number must be shown on any invoice that includes FSC certified products.
         5) Include statement indicating cost for each certified wood product.
      f. Credit EQ 3.1 “Construction Indoor Air Quality Plan - During Construction”:
         1) Construction indoor-air-quality management plan.
         2) Product data for temporary filtration media, including MERV rating.
         3) Product data for filtration media used during occupancy, including MERV rating.

4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.

g. Credit IEQ 3.2 “Construction Indoor Air Quality Plan - Before Occupancy”:
   1) Submit a written construction indoor-air-quality management plan
   2) If Air Flush Out:
      (a) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed, occupancy, outdoor air delivery rates, internal temperature, and humidity as well as any special considerations. Also include a statement that filtration media was replaced after flush-out.
      (b) Product data for filtration media used during flush-out and during occupancy.
   3) If Air Testing:
      (a) Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation verifying that all required contaminants are accounted for and reported in the correct unit of measure.

h. Credit IEQ 4.1 “Low-Emitting Materials - Adhesives & Sealants”: Submit a list of each indoor adhesive product, sealant, and sealant primer used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site).
   1) Include manufacturer's name, product name, and specific VOC data (g/L, less water) for each product, as well as corresponding allowable VOC from the referenced standard.
   2) Submit laboratory test reports and other required documentation for each adhesive and sealant installed in the building interior that it meets the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

i. Credit IEQ 4.2 “Low-Emitting Materials - Paints & Coatings”: Submit a list of each paint and coating used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site).
   1) Include manufacturer's name, product name, and specific VOC data (g/L, less water) for each product, as well as corresponding allowable VOC from the referenced standard.
   2) Submit laboratory test reports and other required documentation for each paint and coating installed in the building interior that it meets the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

j. Credit IEQ 4.3 “Low-Emitting Materials - Flooring Systems”:
   1) Submit a list of each carpet, carpet cushion, and carpet adhesive installed in the building interior. Include manufacturer's name and product name. Record the VOC content for each adhesive.
   2) Submit a list of each hard surface flooring product, tile setting adhesive, finishes, and grout installed in the building interior. Record the VOC content for each tile setting adhesive and grout.

3) Submit laboratory test reports and other required documentation for each flooring element installed in the building interior that it meets the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

k. Credit IEQ 4.4 “Low-Emitting Materials - Composite Wood & Agrifiber Products”:
   1) Submit a list of each composite wood and agrifiber product installed in the building interior.
   2) Submit product data for each product containing composite wood or agrifiber products or wood glues indicating that each product contains no added urea-formaldehyde resins.
   3) Submit product data for each laminating adhesive used to fabricate on-site and shop-applied composite wood and agrifiber assemblies indicating that each does not contain added urea-formaldehyde resins.
   4) Submit laboratory test reports and other required documentation for each composite wood and agrifiber product installed in the building interior that it meets the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

l. Credit IEQ 4.5 “Low-Emitting Materials - Furniture and Furnishings”:
   1) Submit a list of each Classroom furniture including all student desks, tables, an seats that was manufactured, refurbished or refinished within 1 year prior to occupancy. Salvaged and used furniture that is more than 1 year old at time of the occupancy is excluded from the credit requirements. Include manufacturer's name and product name.
   2) Submit required documentation for each furniture element to meet either option 1, 2 or 3.

m. Credit IEQ 4.6 “Low-Emitting Materials - Ceiling and Wall Systems”:
   1) Submit a list of all gypsum board, insulation, acoustical ceiling systems and wall coverings installed in the building interior (defined as, inside the weatherproofing system and applied on-site). Include manufacturer's name and product name.
   2) Submit laboratory test reports and other required documentation for each product that it meets the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

1.06 IFORMATIONAL SUMBITTALS

A. Qualification Data: For LEED coordinator.

B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
   1. Furniture.
   2. Plumbing.
   3. Mechanical.
   4. Electrical.
   5. Specialty items such as elevators and equipment.

6. Wood-based construction materials.

C. LEED Action Plans: Provide preliminary submittals within 30 days of date established for the Notice to Proceed indicating how the following requirements will be met:
   1. Credit MR 2 “Construction Waste Management”: Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."
   2. Credit MR 4 “Recycled Content”: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
   3. Credit MR 5 “Regional Materials”: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
   4. Credit MR 6 “Rapidly Renewable Materials”: List of proposed rapidly renewable materials. Identify each rapidly renewable material, including its source, cost, and the percentage of each product that is rapidly renewable criteria (by weight), and each compliant value.
   5. Credit MR 7 “Certified Wood”: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
   6. Credit IEQ 3.1 “Construction Indoor Air Quality Plan - During Construction”: Construction indoor-air-quality management plan.

D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
   1. Credit MR 2 “Construction Waste Management”: Waste reduction progress reports complying with Section 01 74 19 "Construction Waste Management and Disposal."
   2. Credit MR 4 “Recycled Content”: Recycled content.
   3. Credit MR 5 “Regional Materials”: Regional materials.
   4. Credit MR 6 “Rapidly Renewable Materials”: Rapidly renewable materials.
   5. Credit MR 7 “Certified Wood”: Certified wood products.

1.07 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.02 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4 “Recycled Content”: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content for Project constitutes a minimum of 20 percent of cost of materials used for Project.
   1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.

2. Do not include plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation. Furniture may be included if it is included consistently in MR credits 3-7.

2.03 REGIONAL MATERIALS

A. Credit MR 5 “Regional Materials”: Not less than 20 percent of building materials (by cost) shall be regional materials.
   1. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage (by weight) must contribute to the regional value.
   2. Do not include plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation. Furniture may be included if it is included consistently in MR credits 3-7.

2.04 RAPIDLY RENEWABLE MATERIALS

A. Credit MR 6 “Rapidly Renewable Materials”: Not less than 2.5 percent of the total value of all building materials and products used in the Project, based on cost, shall be rapidly renewable materials.
   1. Furniture may be included if it is included consistently in MR credits 3-7.

2.05 CERTIFIED WOOD

A. Credit MR 7 “Certified Wood”: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
   1. Include only materials permanently installed in the project. Wood Products purchased for temporary use on the project may be included at the project team's discretion. If any such materials are included, all such materials must be included.
   2. Furniture may be included if it is included consistently in MR credits 3-7.
   3. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
      a. Rough carpentry.
      b. Miscellaneous carpentry.
      c. Heavy timber construction.
      d. Wood decking.
      e. Metal-plate-connected wood trusses.
      f. Structural glued-laminated timber.
      g. Finish carpentry.
      h. Architectural woodwork.
      i. Wood paneling.
      j. Wood veneer wall covering.
      k. Wood flooring.
      l. Wood lockers.
      m. Wood cabinets.
      n. Furniture.

2.06 LOW-EMITTING MATERIALS

A. Credit IEQ 4.1 “Low-Emitting Materials - Adhesives & Sealants”: All adhesives and sealants installed in the building interior (defined as, inside the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
   1. School projects may chose from IEQ credits 4.1-4.6 for a maximum of 4 points.

B. Credit IEQ 4.2 “Low-Emitting Materials - Paints & Coatings”: All paints and coatings installed in the building interior (defined as, inside the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
   1. School projects may chose from IEQ credits 4.1-4.6 for a maximum of 4 points.

C. Credit IEQ 4.3 “Low-Emitting Materials - Flooring Systems”: All flooring elements installed in the building interior (defined as, inside the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
   1. School projects may chose from IEQ credits 4.1-4.6 for a maximum of 4 points.

D. Credit IEQ 4.4 “Low-Emitting Materials - Composite Wood & Agrifiber Products”: All composite wood and agrifiber products installed in the building interior (defined as, inside the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
   1. School projects may chose from IEQ credits 4.1-4.6 for a maximum of 4 points.

E. Credit IEQ 4.5 “Low-Emitting Materials - Furniture and Furnishings”: Classroom furniture including all student desks, tables and seats that was manufactured, refurbished or refinished within 1 year prior to occupancy must meet 1 of the following requirements. Salvaged and used furniture that is more than 1 year old at the time of the occupancy is excluded from the credit requirements.
   1. Option 1: Furniture and seating must be GREENGUARD Children and Schools certified.
   2. Option 2: Calculated indoor air concentrations that are less than or equal to those listed in the following table for furniture systems and seating determined by a procedure based on the EPA Environmental Technology Verification (ETV) Large Chamber Test Protocol for Measuring Emissions of VOCs and Aldehydes (September 1999) testing protocol conducted in an independent air quality testing laboratory.

Chemical Contaminant	Classroom Furniture	Seating
Total VOC's	0.5 mg/m3	0.25 mg/m3
Formaldehyde	50 parts per billion	25 parts per billion
Total aldehydes	100 parts per billion	50 parts per billion
4-Phenlycyclohexene (4-PCH)	0.0065 mg/m3	0.00325 mg/m3

   3. Option 3: Calculated indoor air concentrations that are less than or equal to those established in table above for furniture systems and seating determined by a protocol based on ANSI/BIFMA M7.1-2007 and ANSI/BIFMA X7.1-2007 testing protocol conducted in an independent third=party quality testing laboratory.

4. School projects may chose from IEQ credits 4.1-4.6 for a maximum of 4 points.

F. Credit IEQ 4.6 “Low-Emitting Materials - Ceiling and Wall Systems”: All gypsum board, insulation, acoustical ceiling systems and wall coverings installed in the building interior (defined as, inside the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
   1. School projects may chose from IEQ credits 4.1-4.6 for a maximum of 4 points.

PART 3 - PRODUCTS

3.01 MEASUREMENT AND VERIFICATION

A. Credit EA 5 “Measurement and Verification”: Implement measurement and verification plan consistent with either Option B: Energy Conservation Measure Isolation or Option D: Calibrated Simulation, Savings Estimation Method 2 in the EVO's "International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction."

B. If not already in place, install metering equipment to measure energy usage. Monitor, record, and trend log measurements.

C. Evaluate energy performance and efficiency by comparing actual to predicted performance.

D. Measurement and verification period shall cover at least one year of postconstruction occupancy.

3.02 CONSTRUCTION WASTE MANAGEMENT

A. Credit MR 2 "Construction Waste Management": Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.03 CONSTRUCTION INDOOR-AIR-QUALITY MANGEMENT

A. Credit IEQ 3.1 “Construction Indoor Air Quality Management Plan - During Construction”: Develop and implement an IAQ management plan for the construction and preoccupancy phases of the building as follows:
   1. During construction, meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines For Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
   2. Protect stored on-site and installed absorptive materials from moisture damage.
   3. If permanently installed air handlers are used during construction period as specified in Section 01 50 00 "Temporary Facilities and Controls," filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.
   4. Prohibit smoking inside the building and within 25 feet of building entrances once the building is enclosed.

B. Credit IEQ 3.2 “Construction Indoor Air Quality Management Plan - Before Occupancy”: Develop an IAQ management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy. Comply with one of the following requirements:
   1. Flush-Out:
      a. After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total volume of 14,000 cu. ft. of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
      b. If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot of outside air or the design minimum outside air rate determined in Prerequisite EQ 1 “Minimum Air Quality Performance”, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot of outside air has been delivered to the space.
   2. Air Testing:
      a. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "Green Building Design and Construction Reference Guide, 2009 Edition."
      b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:

Contaminant	Maximum Concentration
Total Volatile Organic Compounds (TVOC)	500 micrograms per cubic meter
Formaldehyde	27 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
4-Phenylcyclohexene (4-PH)*	6.5 micrograms per cubic meter
Carbon Monoxide (CO)	9 parts per million and no greater than 2 parts per million above outdoor levels
* This test is required only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.	

      c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from same locations as in the first test, although it is not required.
      d. Conduct the air-sample testing as follows:
         1) All measurements shall be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
         2) All interior finishes must be installed, including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Movable furnishings such as

workstations and partitions should be in place for the testing, although it is not required.

3) The number of sampling locations will depend on the size of building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 square feet or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.
4) Air samples must be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

B. Related Sections include the following:

1. Division 01 Section *"HVAC Commissioning Requirements"* for specific requirements for commissioning HVAC systems.

2. Division 01 Section *"Electrical Commissioning Requirements"* for specific requirements for commissioning electrical systems.

3. Division 01 Section *"Plumbing System Commissioning Requirements"* for specific requirements for commissioning Plumbing systems.

4. Division 01 Section *"Contract Closeout"* for specific requirements for closeout at substantial and final completion.

5. Division 01 Section *"Contract Closeout"* for Specific Requirements for training and demonstration of systems to Owner.

6. Division 01 Section *"Contract Closeout"* for Specific Requirements related to the Preparation of systems operation and maintenance manuals.

1.03 DEFINITIONS

A. CxA: Commissioning Authority.

B. OPR: Owner's Project Requirements.

C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

D. TAB: Testing, Adjusting, and Balancing.

1.04 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract. The CxA for this project shall be performed by EMO Energy Solution, 3141 Fairview Park Drive, Suite 450, Falls Church, Virginia 22042, (703) 205-0445-telephone, (703) 205-0449-fax.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.05 OWNER'S RESPONSIBILITIES

A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:

1. Coordination meetings.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Testing meetings.
4. Demonstration of operation of systems, subsystems, and equipment.

1.06 CONTRACTOR'S RESPONSIBILITIES

A. Provide utility services required for the commissioning process.

B. Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in commissioning and construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in operation and maintenance training sessions.
4. Participate in final review at acceptance meeting.
5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
7. Review and approve final commissioning documentation.
8. Certify that all pre-test work is complete and operational prior to scheduling performed testing by CxA.

C. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in commissioning and construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in procedures meeting for testing.
4. Participate in final review at acceptance meeting.
5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.
6. Provide information to the CxA for developing construction-phase commissioning plan.
7. Participate in training sessions for Owner's operation and maintenance personnel.
8. Provide updated Project Record Documents to the CxA on a daily basis.
9. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Division 01 Section "Operation and Maintenance Data."
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures and participate in testing of installed systems, subsystems, and equipment.

1.07 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Prepare a construction-phase commissioning plan. Collaborate with Contractor and with subcontractors to develop test and inspection procedures. Include design changes and scheduled commissioning activities coordinated with overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.

C. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The CxA shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

D. At a mutually agreed upon time, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.

E. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.

F. Prepare Project-specific test and inspection procedures and checklists.

G. Schedule, direct, witness, and document tests, inspections, and systems startup.

H. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

I. Certify date of acceptance and startup for each item of equipment for start of warranty periods.

J. Review Project Record Documents for accuracy. Request revisions from Contractor to achieve accuracy. Project Record Documents requirements are specified in Division 01 Section "Project Record Documents."

K. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Division 01 Section "Operation and Maintenance Data."

L. Assemble the final commissioning documentation, including the commissioning report and Project Record Documents.

1.08 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: A document, prepared by CxA, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
3. Identification of systems and equipment to be commissioned.
4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.
7. Description of observations to be made.
8. Description of requirements for operation and maintenance training, including required training materials.
9. Description of expected performance for systems, subsystems, equipment, and controls.
10. Schedule for commissioning activities with specific dates coordinated with overall construction schedule.
11. Identification of installed systems, subsystems, and equipment, including design changes that occurred during the construction phase.
12. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
13. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
14. Step-by-step procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.

B. Test Checklists: CxA, with assistance of Contractor and Subcontractors, shall develop test checklists for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. Prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. Provide space for testing personnel to sign off on each checklist. Specific checklist content requirements are specified in Division 01 Section *"HVAC Commissioning Requirements"*, *"Electrical Commissioning Requirements"* and *"Plumbing System Commissioning Requirements."* Test checklists will be jointly developed as the project progresses. Each checklist, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested item.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Deficiencies.
8. Issue number, if any, generated as the result of test.

C. Certificate of Readiness: Certificate of Readiness shall be signed by Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing. Completed test checklists signed by the responsible parties shall accompany this certificate.

D. Test and Inspection Reports: CxA shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

E. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.

F. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

1. Creating an Issues Log Entry:

a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
b. Assign a descriptive title of the issue.
c. Identify date and time of the issue.
d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
e. Identify system, subsystem, and equipment to which the issue applies.
f. Identify location of system, subsystem, and equipment.
g. Include information that may be helpful in diagnosing or evaluating the issue.

h. Note recommended corrective action.
i. Identify commissioning team member responsible for corrective action.
j. Identify expected date of correction.
k. Identify person documenting the issue.

2. Documenting Issue Resolution:

a. Log date correction is completed or the issue is resolved.
b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
c. Identify changes to the Contract Documents that may require action.
d. State that correction was completed and system, subsystem, and equipment is ready for retest, if applicable.
e. Identify person(s) who corrected or resolved the issue.
f. Identify person(s) documenting the issue resolution.

3. Issues Log Report: On a periodic basis, but not less than for each commissioning team meeting, CxA shall prepare a written narrative for review of outstanding issues and a status update of the issues log. As a minimum, CxA shall include the following information in the issues log and expand it in the narrative:

a. Issue number and title.
b. Date of the identification of the issue.
c. Name of the commissioning team member assigned responsibility for resolution.
d. Expected date of correction.

G. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the Contract Documents. The commissioning report shall include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances in the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
2. Commissioning plan.
3. Testing plans and reports.
4. Corrective modification documentation.
5. Issues log.
6. Completed test checklists.
7. Listing of off-season test(s) not performed and a schedule for their completion.

H. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:
1. Project Record Documents as specified in Division 01 Section "Project Record Documents."
2. Final commissioning plan.

3. Commissioning report.
4. Operation and maintenance data as specified in Division 01 Section "Operation and Maintenance Data."

1.09 SUBMITTALS

A. Test Checklists and Report Forms: CxA shall submit sample checklists and forms to Contractor quality-control manager and subcontractors for review and comment. Submit two copies of each checklist and report form.

B. Test and Inspection Reports: CxA shall submit test and inspection reports.

C. Corrective Action Documents: CxA shall submit corrective action documents.

1.10 QUALITY ASSURANCE

A. Instructor Qualifications: Factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

B. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.11 COORDINATION

A. Coordinating Meetings: CxA shall conduct coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

B. Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.

C. Testing Coordination: CxA shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

D. Manufacturers' Field Services: CxA and Contractor shall coordinate services of manufacturers' field services.

1.12 ALTERNATES

A. Refer to Division 01, -*Alternates* for description of work under this section affected by alternates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, CxA shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. In addition to requirements specified in Division 01 Section "Demonstration and Training," perform the following:

1. Review installed systems, subsystems, and equipment.
2. Review instructor qualifications.
3. Review instructional methods and procedures.
4. Review training module outlines and contents.
5. Review course materials (including operation and maintenance manuals).
6. Inspect and discuss locations and other facilities required for instruction.
7. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
8. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

B. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 019114

PLUMBING COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes requirements for commissioning the plumbing system and its subsystems and equipment. This Section supplements the general requirements specified in Division 01 Section "General Commissioning Requirements."

B. Related Sections include the following:

1. Division 01 Section "General Commissioning Requirements" for general requirements for commissioning processes that apply to this Section.

C. The following systems and/or equipment shall be commissioned:

1. Domestic hot water re-circulating system.
2. Domestic hot water heaters.
3. Backflow preventers.
4. Plumbing Fixtures.
5. Domestic water meter (including interlock to ATC system).
6. Thermostatic mixing valves below hand sinks/lavs.
7. Trap priming stations.
8. Shower head flow rates.

1.03 DEFINITIONS

A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of plumbing systems, electrical, communications, controls for plumbing systems, and other related systems.

B. CxA: Commissioning Authority.

C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

D. TAB: Testing, Adjusting, and Balancing.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. The following responsibilities are in addition to those specified in Division 01 Section "General Commissioning Requirements."

B. Contractor:

1. Attend procedures meeting for TAB Work.
2. Certify that TAB Work is complete.

C. Mechanical Contractor:

1. Attend TAB verification testing.
2. Provide measuring instruments and logging devices to record test data, and data acquisition equipment to record data for the complete range of testing for the required test period.

D. HVAC Instrumentation and Control Contractor: With the CxA, review control designs for compliance with the Contract Documents, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions.

E. TAB Subcontractor:

1. Contract Documents Review: With the CxA, review the Contract Documents before developing TAB procedures.

a. Verify the following:

1) Accessibility of equipment and components required for TAB Work.
2) Adequate number and placement of duct balancing dampers to allow proper balancing while minimizing sound levels in occupied spaces.
3) Adequate number and placement of balancing valves to allow proper balancing and recording of water flow.
4) Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and equipment performance data needed to conduct both TAB and commissioning testing.
5) Air and water flow rates have been specified and compared to central equipment output capacities.

b. Identify discontinuities and omissions in the Contract Documents.
c. This review of the Contract Documents by the TAB Subcontractor satisfies requirements for a design review report as specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

2. Additional Responsibilities: Participate in tests specified in Division 23 Sections "Instrumentation & Controls of HVAC & Plumbing Systems."

F. Electrical Contractor:

1. With the Mechanical Contractor, coordinate installations and connections between and among electrical and plumbing systems, subsystems, and equipment.
2. Attend TAB verification testing.

1.05 COMMISSIONING DOCUMENTATION

A. The following are in addition to documentation specified in Division 01 Section "General Commissioning Requirements."

B. Test Checklists: CxA with assistance of Contractor shall develop test checklists for plumbing systems, subsystems, and equipment, including interfaces and interlocks with other systems. CxA shall prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. In addition to the requirements specified in Division 01 Section "General Commissioning Requirements," checklists shall include, but not be limited to, the following:

1. Calibration of sensors and sensor function.
2. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.
3. Control sequences for plumbing systems.
4. Strength of control signal for each set point at specified conditions.
5. Responses to control signals at specified conditions.
6. Sequence of response(s) to control signals at specified conditions.
7. Electrical demand or power input at specified conditions.
8. Power quality and related measurements.
9. Expected performance of systems, subsystems, and equipment at each step of test.
10. Narrative description of observed performance of systems, subsystems, and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
11. Interaction of auxiliary equipment.
12. Issues log.

1.06 SUBMITTALS

A. The following submittals are in addition to those specified in Division 01 Section "General Commissioning Requirements."

B. Testing Procedures: CxA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.

C. Certificate of Readiness: CxA shall compile certificates of readiness from Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing.

D. Certificate of Completion of Installation, Prestart, and Startup: CxA shall certify that installation, prestart, and startup activities have been completed. Certification shall include completed checklists provided by TAB Subcontractor as specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

E. Certified Pipe Cleaning and Flushing Report: CxA shall certify that pipe cleaning, flushing, hydrostatic testing, and chemical treating have been completed.

F. Test and Inspection Reports: CxA shall compile and submit test and inspection reports and certificates, and shall include them in systems manual and commissioning report.

G. Corrective Action Documents: CxA shall submit corrective action documents.

H. Certified TAB Reports: CxA shall submit verified, certified TAB reports.

I. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.07 ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. Prerequisites for Testing:

1. Certify that plumbing systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the Contract Documents; and that Certificates of Readiness are signed and submitted.
2. Certify that plumbing instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents; and that pretest set points have been recorded.
3. Certify that plumbing procedures have been completed, and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.
4. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.

5. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
6. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.
7. Inspect and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable, or failed. Repeat this test for each operating cycle that applies to system being tested.
8. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
9. Annotate checklist or data sheet when a deficiency is observed.
10. Verify equipment interface with monitoring and control system and TAB criteria; include the following:

    a. Flow rates for domestic re-circulating systems.

    b. Discharge temperatures of water heaters.

    c. Re-circ. pump pressures and flow rates.

    d. Domestic water meter total volume in gallons.

    e. Flow rates in gallons per minute for showerheads.

    f. Trap priming station water discharge.

    g. Water heater temperatures and set points.

11. Verify proper responses of monitoring and control system controllers and sensors to include the following:

    a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    b. Report deficiencies and prepare an issues log entry.

12. Verify that plumbing equipment field quality-control testing has been completed and approved. CxA shall direct, witness, and document field quality-control tests, inspections, and startup specified in individual Division 22 Sections.

13. Verify flow rates of all aerators.

14. Verify the operation of all plumbing fixtures.

B. Testing Instrumentation: Install measuring instruments and logging devices to record test data for the required test period. Instrumentation shall monitor and record full range of operating conditions and shall allow for calculation of total capacity of system for each mode of operation. Operational modes include the following:

1. Occupied and unoccupied.
2. Emergency power supply.
3. Life-safety and safety systems.
4. Temporary upset of system operation.
5. Partial occupancy conditions.
6. Special cycles.
7. Alarm conditions.

3.02 TAB VERIFICATION

A. TAB Subcontractor shall coordinate with CxA for work required in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing." TAB Subcontractor shall copy CxA with required reports, sample forms, checklists, and certificates.

B. Contractor, Plumbing Contractor, and CxA shall witness TAB Work.

C. TAB Preparation:

1. TAB Subcontractor shall provide CxA with data required for "Pre-Field TAB Engineering Reports" specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

   a. CxA shall use this data to certify that prestart and startup activities have been completed for systems, subsystems, and equipment installation.

D. Verification of Final TAB Report:

1. CxA shall select, at random, 10 percent of report for field verification.
2. CxA shall notify TAB Subcontractor 10 days in advance of the date of field verification; however, notice shall not include data points to be verified. The TAB Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item is defined as follows:

   a. A deviation of more than 10 percent.

4. Failure of more than 10 percent of selected items shall result in rejection of final TAB report.

E. If deficiencies are identified during verification testing, CxA shall notify the HVAC Contractor and Architect, and shall take action to remedy the deficiency. Architect shall review final tabulated checklists and data sheets to determine if verification is complete and that system is operating according to the Contract Documents.

F. CxA shall certify that TAB Work has been successfully completed.

3.03 TESTING

A. Test systems and intersystem performance after test checklists for systems, subsystems, and equipment have been approved.

B. Perform tests using design conditions whenever possible.

1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CxA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
2. Alter set points when simulating conditions is not practical and when written approval is received from CxA.
3. Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical. Do not use sensor to act as signal generator to simulate conditions or override values.

C. Scope of Plumbing Contractor Testing:

1. Testing scope shall include entire plumbing installation, from central hot water heating equipment for heat generation through distribution systems to each fixture. It shall include measuring capacities and effectiveness of operational and control functions.
2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
3. Test all plumbing fixtures.
4. Test time to reach temperature and temperature of hot water at all fixtures with thermostatic mixing valves.
5. Test discharge of water at all trap priming stations.
6. Verify that all backflow preventers have been tested. Document in writing.
7. Test operation of all water meters.
8. Test domestic water heaters.
9. Test water meters and interlock with ATC system.
10. Test operation, set points, and safeties of water heaters.

D. Detailed Testing Procedures: CxA, with Plumbing Contractor, TAB Subcontractor, and Plumbing Instrumentation and Control Contractor, shall prepare detailed testing plans, procedures, and checklists for plumbing systems, subsystems, and equipment.

E. HVAC Instrumentation and Control System Testing:

1. Field testing plans and testing requirements are specified in Division 23 Section "Instrumentation & Controls of HVAC & Plumbing Systems." The CxA, Plumbing Contractor, and the HVAC Instrumentation and Control Contractor shall collaborate to prepare testing plans.
2. CxA shall convene a meeting of appropriate entities to review test report of HVAC instrumentation and control systems.

F. Plumbing System Testing: Plumbing Contractor shall prepare a testing plan to verify performance of water heaters, domestic re-circulating systems, backflow preventers, plumbing

fixtures, trap priming stations, domestic pumps, domestic water meters, and thermostatic mixing valves. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings for each pipe sector showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
2. Tracking checklist for managing and ensuring that all pipe sections have been tested.
3. Design and actual measurements for all equipment.

G. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the plumbing system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

H. Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
2. Include data sheets for each controller to verify proper operation of the control system, the system it serves, the service it provides, and its location. For each controller, provide space for recording its readout, the reading at the controller's sensor(s), plus comments. Provide space for testing personnel to sign off on each data sheet.
3. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.

END OF SECTION

SECTION 01 91 15

HVAC COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes requirements for commissioning the HVAC system and its subsystems and equipment. This Section supplements the general requirements specified in Division 01 Section "General Commissioning Requirements."

B. Related Sections include the following:

1. Division 01 Section "General Commissioning Requirements" for general requirements for commissioning processes that apply to this Section.

C. The following systems and/or equipment shall be commissioned:

1. Exhaust air systems.
2. HVAC controls and sequences of operation.
3. Energy recovery ventilators (Including variable frequency drives).
4. Air flow monitoring station.
5. Ductless heat pumps.
6. Exhaust Fans and ventilation fans.
7. Automatic Temperature Control System.
8. Variable refrigerant volume systems (indoor and outdoor units).
9. Variable refrigerant volume system ATC interface and systems integration.
10. Water meter/ATC interface.
11. Duct detectors.
12. Electric Heaters.

1.03 DEFINITIONS

A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems.

B. CxA: Commissioning Authority.

C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

D. TAB: Testing, Adjusting, and Balancing.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. The following responsibilities are in addition to those specified in Division 01 Section "General Commissioning Requirements."

B. Contractor:

1. Attend procedures meeting for TAB Work.
2. Certify that TAB Work is complete.

C. Mechanical Contractor:

1. Attend TAB verification testing.
2. Provide measuring instruments and logging devices to record test data, and data acquisition equipment to record data for the complete range of testing for the required test period.

D. HVAC Instrumentation and Control Contractor: With the CxA, review control designs for compliance with the Contract Documents, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions.

E. TAB Subcontractor:

1. Contract Documents Review: With the CxA, review the Contract Documents before developing TAB procedures.

a. Verify the following:

1) Accessibility of equipment and components required for TAB Work.
2) Adequate number and placement of duct balancing dampers to allow proper balancing while minimizing sound levels in occupied spaces.
3) Adequate number and placement of balancing valves to allow proper balancing and recording of water flow.
4) Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and equipment performance data needed to conduct both TAB and commissioning testing.
5) Air and water flow rates have been specified and compared to central equipment output capacities.

b. Identify discontinuities and omissions in the Contract Documents.
c. This review of the Contract Documents by the TAB Subcontractor satisfies requirements for a design review report as specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

2. Additional Responsibilities: Participate in tests specified in Division 23 Sections "Instrumentation & Controls of HVAC & Plumbing Systems."

F. Electrical Contractor:

1. With the Mechanical Contractor, coordinate installations and connections between and among electrical and HVAC systems, subsystems, and equipment.
2. Attend TAB verification testing.

1.05 COMMISSIONING DOCUMENTATION

A. The following are in addition to documentation specified in Division 01 Section "General Commissioning Requirements."

B. Test Checklists: CxA with assistance of Contractor shall develop test checklists for HVAC systems, subsystems, and equipment, including interfaces and interlocks with other systems. CxA shall prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. In addition to the requirements specified in Division 01 Section "General Commissioning Requirements," checklists shall include, but not be limited to, the following:

1. Calibration of sensors and sensor function.
2. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.
3. Control sequences for HVAC systems.
4. Strength of control signal for each set point at specified conditions.
5. Responses to control signals at specified conditions.
6. Sequence of response(s) to control signals at specified conditions.
7. Electrical demand or power input at specified conditions.
8. Power quality and related measurements.
9. Expected performance of systems, subsystems, and equipment at each step of test.
10. Narrative description of observed performance of systems, subsystems, and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
11. Interaction of auxiliary equipment.
12. Issues log.

1.06 SUBMITTALS

A. The following submittals are in addition to those specified in Division 01 Section "General Commissioning Requirements."

B. Testing Procedures: CxA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.

C. Certificate of Readiness: CxA shall compile certificates of readiness from Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing.

D. Certificate of Completion of Installation, Prestart, and Startup: CxA shall certify that installation, prestart, and startup activities have been completed. Certification shall include completed checklists provided by TAB Subcontractor as specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

E. Test and Inspection Reports: CxA shall compile and submit test and inspection reports and certificates, and shall include them in systems manual and commissioning report.

F. Corrective Action Documents: CxA shall submit corrective action documents.

G. Certified TAB Reports: CxA shall submit verified, certified TAB reports.

H. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.07 ALTERNATES

A. Refer to Division 01, -*Alternates* for description of work under this section affected by alternates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. Prerequisites for Testing:

1. Certify that HVAC systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the Contract Documents; and that Certificates of Readiness are signed and submitted.
2. Certify that HVAC instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents; and that pretest set points have been recorded.
3. Certify that TAB procedures have been completed, and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

4. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.
5. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
6. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.
7. Inspect and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable, or failed. Repeat this test for each operating cycle that applies to system being tested.
8. Check safety cutouts, alarms, and interlocks with duct detectors and life-safety systems during each mode of operation.
9. Annotate checklist or data sheet when a deficiency is observed.
10. Verify equipment interface with monitoring and control system and TAB criteria; include the following:

    a. Supply and return flow rates for ERV and constant volume systems in each operational mode.
    b. Operation of heat pump units in both heating and cooling cycles.
    c. Minimum outdoor-air intake in each operational mode and at minimum and maximum airflows.
    d. Total exhaust airflow and total outdoor-air intake.
    e. Supply, outside air, exhaust and return air flow rates for ERVs in each operating mode.
    f. Sequences of operation of all HVAC equipment.
    g. Ductless heat pumps and air conditioning units with air flow rates and temperatures.
    h. Variable speed drive parameters at each operated mode.
    i. Electric heating equipment volts, amps, and temperature rise.
    j. Supply and return air flow rates for ERV units.
    k. Operation/Accuracy of air flow measuring stations at various flow rates.
    l. Operation of variable refrigerant flow systems in all modes.

11. Verify proper responses of monitoring and control system controllers and sensors to include the following:

    a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    b. Report deficiencies and prepare an issues log entry.

12. Verify that HVAC equipment field quality-control testing has been completed and approved. CxA shall direct, witness, and document field quality-control tests, inspections, and startup specified in individual Division 23 Sections.

B. Testing Instrumentation: Install measuring instruments and logging devices to record test data for the required test period. Instrumentation shall monitor and record full range of operating conditions and shall allow for calculation of total capacity of system for each mode of

operation. For individual room cooling tests, provide temporary heaters to impose a cooling load. Operational modes include the following:

1. Heating/Cooling Mode.
2. Occupied and unoccupied.
3. Warm up and cool down.
4. Life-safety and safety systems.
5. Duct detectors.
6. Fire safety.
7. Temporary upset of system operation.
8. Partial occupancy conditions.
9. Special cycles.
10. ERV supply/exhaust flow at partial CO2 levels.
11. Variable refrigerant volume units in heating/cooling modes.

3.02 TAB VERIFICATION

A. TAB Subcontractor shall coordinate with CxA for work required in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing." TAB Subcontractor shall copy CxA with required reports, sample forms, checklists, and certificates.

B. Contractor, HVAC Contractor, and CxA shall witness TAB Work.

C. TAB Preparation:

1. TAB Subcontractor shall provide CxA with data required for "Pre-Field TAB Engineering Reports" specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

   a. CxA shall use this data to certify that prestart and startup activities have been completed for systems, subsystems, and equipment installation.

D. Verification of Final TAB Report:

1. CxA shall select, at random, 10 percent of report for field verification.
2. CxA shall notify TAB Subcontractor 10 days in advance of the date of field verification; however, notice shall not include data points to be verified. The TAB Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item is defined as follows:

   a. For all readings a deviation of more than 10 percent.

4. Failure of more than 10 percent of selected items shall result in rejection of final TAB report.

E. If deficiencies are identified during verification testing, CxA shall notify the HVAC Contractor and Architect, and shall take action to remedy the deficiency. Architect shall review final tabulated checklists and data sheets to determine if verification is complete and that system is operating according to the Contract Documents.

F. CxA shall certify that TAB Work has been successfully completed.

3.03 TESTING

A. Test systems and intersystem performance after test checklists for systems, subsystems, and equipment have been approved.

B. Perform tests using design conditions whenever possible.

1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CxA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
2. Alter set points when simulating conditions is not practical and when written approval is received from CxA.
3. Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical. Do not use sensor to act as signal generator to simulate conditions or override values.

C. Scope of HVAC Contractor Testing:

1. Testing scope shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. It shall include measuring capacities and effectiveness of operational and control functions.
2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Detailed Testing Procedures: CxA, with HVAC Contractor, TAB Subcontractor, and HVAC Instrumentation and Control Contractor, shall prepare detailed testing plans, procedures, and checklists for HVAC systems, subsystems, and equipment.

E. HVAC Instrumentation and Control System Testing:

1. Field testing plans and testing requirements are specified in Division 23 Section "Instrumentation & Controls of HVAC & Plumbing Systems". The CxA, HVAC Contractor, Equipment Provider/Manufacturer and the HVAC Instrumentation and Control Contractor shall collaborate to prepare testing plans.
2. CxA shall convene a meeting of appropriate entities to review test report of HVAC instrumentation and control systems.

F. Heat-Generation System Testing: HVAC Contractor shall prepare a testing plan to verify performance of heat pumps, energy recovery ventilators, variable refrigerant volume units, unit heaters. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings for each pipe sector showing the physical location of each item of equipment and pipe test

section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
2. Tracking checklist for managing and ensuring that all pipe sections have been tested.
3. Variable refrigerant flow equipment volts, amps, temperatures, and modes of operation.

G. Refrigeration System Testing: HVAC Contractor shall prepare a testing plan to verify performance of heat pumps, ERV units, variable refrigerant volume systems, ductless units, and other refrigeration systems. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
2. Tracking checklist for managing and ensuring that all pipe sections have been tested.
3. Variable refrigerant flow equipment volts, amps, temperatures, and modes of operation.

H. HVAC Distribution System Testing: HVAC Contractor shall prepare a testing plan to verify performance of air, ERV unit supply and exhaust, and other distribution systems. Include HVAC terminal equipment and unitary equipment. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
2. Tracking checklist for managing and ensuring that all pipe sections have been tested.
3. ERV unit, air flow rates, air temperatures, fluid flow rates, safeties, and demand controlled ventilation.

I. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

J. Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
2. Include data sheets for each controller to verify proper operation of the control system, the system it serves, the service it provides, and its location. For each controller, provide space for recording its readout, the reading at the controller's sensor(s), plus comments. Provide space for testing personnel to sign off on each data sheet.
3. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.

END OF SECTION

SECTION 01 91 16

ELECTRICAL SYSTEMS COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for commissioning the electrical system and its subsystems and equipment. This Section supplements the general requirements specified in Division 01 Section "General Commissioning Requirements."

B. Related Sections include the following:

1. Division 01 Section "General Commissioning Requirements" for general requirements for commissioning processes that apply to this Section.

C. The following systems and/or equipment shall be commissioned.

1. Sports lighting.
2. Lighting control systems.
3. Electrical distribution system.
4. Communication systems.
5. Fire Alarm System.
6. Security System.
7. Exterior lighting and associated controls.
8. Electrical distribution system.
   a. Distribution panelboards.
   b. Safety/disconnect switches.
   c. Motor starters.
   d. Lighting contactors.
9. Communication systems.
   a. Data systems.
   b. Telephone/intercom.
10. Emergency Lighting.
11. Local AV Systems.

1.3 DEFINITIONS

A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of electrical systems, electrical, communications, and other related systems.

B. CxA: Commissioning Authority.

C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. The following responsibilities are in addition to those specified in Division 01 Section "General Commissioning Requirements."

B. Electrical Contractor:

1. Provide certified and calibrated measuring instruments and logging devices to record test data, and data acquisition equipment to record data for the complete range of testing for the required test period.

C. Electrical Contractor:

1. With the Mechanical Contractor, coordinate installations and connections between and among electrical and HVAC systems, subsystems, and equipment.

2. Attend TAB verification testing.

1.5 COMMISSIONING DOCUMENTATION

A. The following are in addition to documentation specified in Division 01 Section "General Commissioning Requirements."

B. Test Checklists: CxA with assistance of Contractor shall develop test checklists for electrical systems, subsystems, and equipment, including interfaces and interlocks with other systems. CxA shall prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. In addition to the requirements specified in Division 01 Section "General Commissioning Requirements," checklists shall include, but not be limited to, the following:

1. Calibration of sensors and sensor function.

2. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.

3. Control sequences for electrical systems.

4. Strength of control signal for each set point at specified conditions.

5. Responses to control signals at specified conditions.

6. Sequence of response(s) to control signals at specified conditions.

7. Electrical demand or power input at specified conditions.

8. Power quality and related measurements.
9. Expected performance of systems, subsystems, and equipment at each step of test.
10. Narrative description of observed performance of systems, subsystems, and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
11. Interaction of auxiliary equipment.
12. Issues log.

1.6 SUBMITTALS

A. The following submittals are in addition to those specified in Division 01 Section "General Commissioning Requirements."

B. Testing Procedures: CxA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.

C. Certificate of Readiness: CxA shall compile certificates of readiness from Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing.

D. Certificate of Completion of Installation, Prestart, and Startup: CxA shall certify that installation, prestart, and startup activities have been completed.

E. Test and Inspection Reports: CxA shall compile and submit test and inspection reports and certificates, and shall include them in systems manual and commissioning report.

F. Corrective Action Documents: CxA shall submit corrective action documents.

1.7 ALTERNATES

A. Refer to Division 01, -*Alternates* for description of work under this section affected by alternates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Prerequisites for Testing:

1. Certify that electrical systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the Contract Documents; and that Certificates of Readiness are signed and submitted.
2. Certify that electrical instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents; and that pretest set points have been recorded.

3. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.
4. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
5. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.
6. Inspect and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable, or failed. Repeat this test for each operating cycle that applies to system being tested.
7. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
8. Annotate checklist or data sheet when a deficiency is observed.
9. Verify proper responses of monitoring and control system controllers and sensors to include the following:
    a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    b. Report deficiencies and prepare an issues log entry.

3.2 TESTING

A. Test systems and intersystem performance after test checklists for systems, subsystems, and equipment have been approved.

B. Perform tests using design conditions whenever possible.
    1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CxA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

C. Scope of Electrical Contractor Testing:
    1. Testing scope shall include entire electrical installation, from incoming service through distribution systems to each space. It shall include measuring voltages and currents and effectiveness of operational and control functions.
    2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Detailed Testing Procedures: CxA, with Electrical Contractor shall prepare detailed testing plans, procedures, and checklists for electrical systems, subsystems, and equipment.

E. Electrical System Testing: Electrical Contractor shall prepare a testing plan to verify performance of emergency generator, lighting control systems, electrical distribution systems, communication systems, security systems, exterior lighting control systems, electrical distribution systems, fire alarm and voice evacuation system, stage lighting/dimming system. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of wiring to be tested, identified by identification marker. Markers shall be keyed to Drawings for each wiring sector showing the physical location of each item of equipment and electrical wiring test section. Drawings shall be formatted to allow each item of equipment and section of wiring to be physically located and identified when referred to in the system testing plan.

2. Tracking checklist for managing and ensuring that all wiring systems have been tested.

F. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the electrical system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.

2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

G. Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.

2. Include data sheets for each electrical systems to verify proper operation of the electrical systems, the system it serves, the service it provides, and its location. Provide space for testing personnel to sign off on each data sheet.

3. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Concrete formwork.

C. Floors and slabs on grade.

D. Concrete foundations.

E. Concrete reinforcement.

F. Joint devices associated with concrete work.

G. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.

H. Concrete curing.

1.02 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; 2010.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).

C. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute International; 1998 (Reapproved 2004).

D. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.

E. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).

F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

G. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

H. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

I. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

J. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.

K. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute International; 2004.

L. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

M. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2012.

N. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2011a.

O. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

P. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.

Q. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete; 2009.

R. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.

S. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).

T. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Samples: Submit samples of underslab vapor retarder to be used.

D. LEED Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used; use LEED New Product Content Form.

E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347 to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).

B. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.
   1. Form: Flat Sheets.

2. Mesh Size and Wire Gage: As indicated on drawings.

C. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gage.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C 33.

C. Lightweight Aggregate: ASTM C 330.

D. Fly Ash: ASTM C618, Class C or F.

E. Water: Clean and not detrimental to concrete.

2.04 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
2. Products:
a. Insulation Solutions, Inc; Viper VaporCheck II 15-mil (Class A): www.insulationsolutions.com.
b. Stego Industries, LLC; Stego Wrap Vapor Barrier 15-mil (Class A): www.stegoindustries.com.
c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

C. Moisture-Retaining Cover: ASTM C 171; regular curing paper, clear polyethylene, or white burlap-polyethylene sheet.

2.05 BONDING AND JOINTING PRODUCTS

A. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

2.06 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

B. Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.
1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

C. Concrete Strength: Establish required average strength for each type of concrete on the basis of trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

D. Normal Weight Concrete:
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 psi.

E. Structural Lightweight Concrete:
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.02 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.04 SLAB JOINTING

A. Locate joints as indicated on the drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.
2. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

B. Measure F(F) and F(L) in accordance with ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.

C. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 301.1R; thin floor coverings include carpeting, resilient flooring, and seamless flooring.
   2. Other Surfaces to Be Left Exposed: "Steel trowel" as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms:
   1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
   2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-fog spray, or saturated burlap.
   3. Final Curing: Begin after initial curing but before surface is dry.
      a. Moisture-Retaining Cover: Seal in place with waterproof tape or adhesive.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.09 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Concrete Block.
   1. Standard concrete masonry units.

C. Clay Facing Brick.

D. Mortar and Grout.

E. Reinforcement and Anchorage.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 72 00 - Cast Stone masonry

B. Section 07 26 40 Spray PolyurethaneFoam Insulating Air Barrier: Insulation for cavity spaces.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

1.03 ALTERNATES

A. Refer to Section 01 23 00 - Alternates, for description of work under this Section affected by alternates.

1.04 REFERENCE STANDARDS

A. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a.

D. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2011b.

E. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

F. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

G. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

H. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

I. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2011.

J. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2012.

K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

L. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

M. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2008) .

N. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2011a.

O. ASTM C1357 - Standard Test Methods for Evaluating Masonry Bond Strength; 2009.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples for Verification: For each type and color of the following:
   1. Face brick in the form of straps of five or more bricks.

D. Shop Drawings: For the following:
   1. Embedded Masonry Flashing: showing location of each course in wall section and plan view of each course with all details and stop ends referenced.

E. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

F. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

1.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories and structural backup in mock-up.

B. Locate where directed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
   2. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
   3. Special Shapes: Provide non-standard blocks configured for corners.
      a. Provide bullnose blocks at exposed corners.
   4. Load-Bearing Units: ASTM C90, normal weight.
   5. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid or powder admixture added to concrete masonry units at the time of manufacture.
      a. Performance of Units with Integral Water Repellent:

1) Water Permeance: When tested per ASTM E514 and for a minimum of 72 hours.
   (a) No water visible on back of wall above flashing at the end of 24 hours.
   (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
   (c) No more than 25% of wall area above flashing visibly damp at end of test.
2) Flexural Bond Strength: ASTM C1357; minimum 10% increase.
3) Compressive Strength: ASTM C1314; maximum 5% decrease.
4) Drying Shrinkage: ASTM C1148; maximum 5% increase in shrinkage.

b. Use only in combination with mortar and grout that also has integral water repellent admixture.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Regional Materials: Provide brick that has been manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
   2. Actual size: Standard Modular, 2-1/4 by 7-5/8 by 3-5/8.
   3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   4. Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
      a. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
      b. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
      c. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
      d. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
      e. Provide lipped brick at lintels and relieving angles.
      f. Provide soldier course corner bricks.

B. Face Brick: Facing brick complying with ASTM C 216.
   1. Face Brick A:
      a. Texture: Smooth.
      b. A blend of minimum (4) different reds of a narrow range.
      c. Basis-of-Design Product: Subject to compliance with requirements, provide Colony Red Range as manufactured by Belden.
   2. Face Brick B:
      a. Texture: Knife cut.
      b. Color: Dark Red/Brown.
      c. Basis-of-Design Product: Subject to compliance with requirements, provide Kingsport Knifecut as manufactured by Belden.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91, Not Permitted.

B. Portland Cement: ASTM C150, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

G. Integral Water Repellent Admixture for Mortar and Grout: Polymeric liquid or powder admixture added to mortar and grout at the time of manufacture.
   1. Performance of Mortar and Grout with Integral Water Repellent:
      a. Water Permeance: When tested per ASTM E514 for a minimum of 72 hours.
         1) No water visible on back of wall above flashing at the end of 24 hours.
         2) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
         3) No more than 25% of wall area above flashing visibly damp at end of test.
      b. Flexural Bond Strength: ASTM C1357; minimum 10% increase.
      c. Compressive Strength: ASTM C1314; maximum 5% decrease.
      d. Drying Shrinkage: ASTM C1148; maximum 5% increase in shrinkage.
   2. Use only in combination with masonry units produced with integral water repellent admixture.

2.04 REINFORCEMENT AND ANCHORAGE

A. Single Wythe Joint Reinforcement: Truss type; ASTM A 82/A 82M steel wire, mill galvanized to ASTM A 641/A 641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

B. Adjustable Multiple Wythe Joint Reinforcement: Ladder type with adjustable ties or tabs spaced at 16 in on center and fabricated with moisture drip; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face.
   1. Vertical adjustment: Not less than 2 inches.

C. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

2.05 FLASHINGS

A. Flashing Type 1: Manufacturer's standard Elvaloy-modified flashing of type indicated below:
   1. Hyload SA Cloaked Flashing System:
      a. 40 mils minimum thickness, glass reinforced.
      b. UV resistant.
      c. Color: black.
      d. Provide all mastic and primer as recommended by manufacturer.

B. Drip Edge: Install Flashing with a minimum 3 inch, extruded drip extending 3/8 inch beyond the face of building, unless otherwise directed by Architect.
   1. Stainless Steel Drip Edge manufactured by Hohmann & Barnard, Inc.

C. Cloaks: Provide manufacturer's extruded pre-formed shapes for integration with embedded flashing at all inside corners, outside corners and at all change in elevations in embedded flashing system.

D. Stop Ends: Locate "Stop Ends" at all windowsills, headers and inside corner terminations.

E. Shelf Angles & Lintels: Flashing must be carried through the wall to prevent water from bypassing flashing.

F. Shelf Angle Soft Joints: Flashing Membrane or Drip must be compatible with wet sealant. Provide letter from flashing manufacturer addressing sealant compatibility.

2.06 ACCESSORIES

A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell neoprene; oversized 50 percent to joint width; self expanding; 3.5 inch wide x by maximum lengths available.
   1. Manufacturers:
      a. Williams Products, Inc.; Product Type NN1, 1040 Series.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Panels designed for installation at flashing locations.
      a. Manufacturers:
         1) Advanced Building Products Inc: www.advancedflashing.com.
         2) Mortar Net USA, Ltd: www.mortarnet.com.
         3) Substitutions: See Section 01 60 00 - Product Requirements.

D. Weeps: Open Head Joints.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type M.
   2. Exterior, loadbearing masonry: Type S.
   3. Exterior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave, except at masonry to receive spray foam provide flush joints fully filled with mortar and mortar droppings removed from ties.

C. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where resilient base is scheduled or cavity insulation vapor barrier adhesive is applied.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Masonry Back-Up: Embed anchors to bond veneer at maximum 24 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Extend through-wall flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

C. Lap end joints of flashings at least 4 inches and seal with compatable sealant or self-sealing falshing.

3.11 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.12 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.13 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.14 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.16 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 04 72 00

CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Architectural cast stone.

C. Units required are:
   1. Exterior wall units, including wall caps, coping, and sills.
   2. Other items indicated on the drawings.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Installation of cast stone in conjunction with masonry.

B. Section 07 90 05 - Joint Sealers: Materials and execution methods for sealing soft joints in cast stone work.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.

B. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2012.

D. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2011a.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2012.

G. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2011.

H. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2006.

I. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2010b.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

C. Product Data: Test results of cast stone components made previously by the manufacturer.

D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

E. Mortar Color Selection Samples.

F. Verification Samples: Pieces of actual cast stone components not less than 12 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

G. Source Quality Control Test Reports.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A current producer member of the Cast Stone Institute with a minimum of 5 years of experience in producing cast stone of the types required for project and:
   1. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
   2. Products previously produced by plant and exposed to weather that exhibit satisfactory appearance.

B. Mock-Up: Provide full size cast stone components for installation in mock-up of exterior wall.
   1. Approved mock-up will become standard for appearance and workmanship.
   2. Mock-up may remain as part of the completed work.

C. Source Quality Control: Test compressive strength and absorption of specimens selected at random from plant production.
   1. Test in accordance with ASTM C642.
   2. Select specimens at rate of 3 per 500 cubic feet, with a minimum of 3 per production week.
   3. Submit reports of tests by independent testing agency, showing compliance with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone:
   1. Continental Cast Stone Manufacturing, Inc,.
   2. RockCast, A Division of Reading Rock, Inc..

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   4. Color: Match sample on file at Architect 's office.
   5. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.
   1. Pieces More than 12 inches Wide: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

2.03 MATERIALS

A. Portland Cement: ASTM C150.
   1. For Units: Type I, white or gray as required to match Architect 's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized or epoxy coated.

G. Steel Welded Wire Reinforcement: ASTM A185/A185M, galvanized or epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Mortar: Portland cement-lime, ASTM C270, Type N; do not use masonry cement.

J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

D. Joints: Make all joints 3/8 inch, except as otherwise detailed.
   1. Rake mortar joints 3/4 inch for pointing.
   2. Remove excess mortar from face of stone before pointing joints.
   3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
   4. Leave the following joints open for sealant:
      a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
      b. Joints in projecting units.
      c. Joints between rigidly anchored units, including soffits, panels, and column covers.
      d. Joints below lugged sills and stair treads.
      e. Joints below ledge and relieving angles.
      f. Joints labeled "expansion joint".

E. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
   1. Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer's instructions.
   2. Repair methods and results subject to Architect 's approval.

3.02 CLEANING

A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
   1. Wet surfaces with water before applying cleaner.
   2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
   3. Remove cleaner promptly by rinsing thoroughly with clear water.
   4. Do not use acidic cleaners.

3.03 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Structural steel framing members, support members.

C. Base plates, shear stud connectors and expansion joint plates.

D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joist Framing.

B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2005.

B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2005.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2007.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2010.

H. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.

I. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2009.

J. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2007.

K. ASTM A514/A514M - Standard Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2005 (Reapproved 2009).

L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011.

M. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2011.

N. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2009.

O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections not detailed.
   3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Rolled Steel Structural Shapes: ASTM A992/A992M.

C. Hot-Formed Structural Tubing: ASTM A501, seamless or welded.

D. Steel Bars: ASTM A108.

E. Steel Plate: ASTM A514/A514M.

F. Pipe: ASTM A53/A53M, Grade B, Finish black.

G. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars.

H. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A galvanized to ASTM A 153/A 153M, Class C.

I. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, medium carbon, galvanized.

J. Load Indicator Washers: Provide washers complying with ASTM F959 at all connections requiring high-strength bolts.

K. Welding Materials: AWS D1.1; type required for materials being welded.

L. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

M. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

N. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

PART 3 EXECUTION

3.01 ERECTION

A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".

B. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 21 00

STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.

C. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

D. Supplementary framing for roof openings greater than 18 inches.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.

B. Section 05 31 00 - Steel Decking: Bearing plates and angles.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2010.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

E. SJI (SPEC) - Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders; Steel Joist Institute; 2005.

F. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; Steel Joist Institute; 2008.

G. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).

H. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. Manufacturer's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Perform Work, including that for headers and other supplementary framing, in accordance with SJI Standard Specifications Load Tables and SJI Technical Digest No.9.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Open Web Joists: SJI Type K Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
   3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
   4. Finish: Shop primed.

B. Open Web Joists: SJI Type LH Joists:

C. Anchor Bolts, Nuts and Washers: ASTM A 307, hot-dip galvanized per ASTM A 153/A 153M, Class C.

D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A 36/A 36M.

E. Welding Materials: AWS D1.1; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 25, zinc oxide, complying with VOC limitations of authorities having jurisdiction.

2.02 FINISH

A. Shop prime joists as specified.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Install supplementary framing for floor and roof openings greater than 18 inches.

F. Do not permit erection of decking until joists are braced bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

G. Do not field cut or alter structural members without approval of joist manufacturer.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Alignment: 1/4 inch.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Roof deck.

C. Supplementary framing for openings up to and including 18 inches.

D. Bearing plates and angles.

1.02 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joist Framing: Support framing for openings larger than 18 inches and shear stud connectors.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

E. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society; 2008.

F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

G. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; ICC Evaluation Service, Inc.; 2012.

H. SDI (DM) - Publication No.31, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute; 2007.

I. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); The Society for Protective Coatings; 2002 (Ed. 2004).

1.04 QUALITY ASSURANCE

A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Delaware.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel (AC172).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 STEEL DECK

A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.

B. Roof Deck: Non-composite type, fluted steel sheet:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

2.02 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.

B. Welding Materials: AWS D1.1.

C. Fasteners: Galvanized hardened steel, self tapping.

D. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

E. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

G. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

2.03 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips and cover plates, 22 gage thick sheet steel; of profile and size as indicated; finished same as deck.

PART 3 EXECUTION

3.01 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On masonry surfaces provide minimum 4 inch bearing.

C. On steel supports provide minimum 1-1/2 inch bearing.

D. At mechanically fastened male/female side laps fasten at 24 inches on center maximum.

E. Weld deck in accordance with AWS D1.3.

F. At deck openings from 6 inches to 18 inches in size, provide 2 x 2 x 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.

G. Where deck changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.

H. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

I. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

J. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Formed steel stud exterior wall framing.

C. Exterior wall sheathing.

1.02 RELATED REQUIREMENTS

A. Section 07 21 29 Sprayed Insulation: Spray insulation applied over wall sheathing.

1.03 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.

E. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Provide design engineer's stamp on shop drawings.

D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.02 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and depth: As indicated on the drawings.
   2. Galvanized in accordance with ASTM A653/A653M G90/Z275 coating.

B. Framing Connectors: Factory-made formed steel sheet, ASTM A653/A653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.
   1. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members; minimum 16 gage, 0.06 inch thickness.
   2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, screws and anti-friction bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
      a. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
   3. Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.03 WALL SHEATHING

A. Wall Sheathing: Glass mat faced gypsum; ASTM C1177/C1177M, square long edges, 5/8 inch Type X fire-resistant.

2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Drilled expansion bolts.

C. Welding: In conformance with AWS D1.1.

PART 3 EXECUTION

3.01 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

E. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

F. Install intermediate studs above and below openings to align with wall stud spacing.

G. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

H. Attach cross studs to studs for attachment of fixtures anchored to walls.

I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

J. Touch-up field welds and damaged galvanized surfaces with primer.

3.02 WALL SHEATHING

A. Wall Sheathing: Secure with long dimension parallel to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Paint finish.

1.03 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.

E. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2009.

F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

H. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

I. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

B. Slotted Channel Framing: ASTM A653, Grade 33.

C. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
   2. Rungs: one inch diameter solid square bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.
   4. Provide brackets at top and bottom, welded to rails and bolted to building structure.

B. Bollards: 6 inch steel pipe, 3,00 psi concrete filled, crowned cap, as detailed; prime paint finish.

C. Steel Angle Vanity Support: ASTM A 36/A 36M steel angles, welded to support vanities with anchoring devices and sizes as indicated in shop drawings.

2.04 MANUFACTURED PRODUCTS

A. Access panel: Provide Milcor or equal prime coated steel access panel with screw cam operated locks.

2.05 FINISHES - STEEL

A. Prime paint all steel items.
   1. Exceptions: Galvanize items to be embedded in concrete or masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Prime Painting: One coat.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Roofing nailers.

C. Fire retardant treated wood materials.

D. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

D. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2010.

E. PS 1 - Structural Plywood; 2007.

F. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. LEED Submittals: Submit applicable LEED Submittal Form for each different product made of sustainably harvested wood, salvaged and reused wood, wood fabricated from recovered timber, as well as locally-sourced wood, as specified in Section 01 35 15.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood; see Section 01 60 00 for requirements.

D. Provide wood harvested within a 500 mile radius of the project site; see Section 01 60 00 for requirements for locally-sourced products.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, square long edges, 5/8 inch Type X fire-resistant. See Section 05 40 00.

B. Other Applications:
1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:
1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

3.04 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 74 19.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Finish carpentry items.

C. Hardware and attachment accessories.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

C. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards.

D. Samples: Submit two samples of wood trim 12 inch long.

E. LEED Report: Submit for wood products made from sustainably harvested wood, salvaged and reused wood, wood fabricated from recovered timber, and locally-sourced wood, as specified in Section 01 35 15.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI Architectural Woodwork Standards for Premium Grade.

B. Interior Woodwork Items:

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide wood harvested within a 500 mile radius of the project site.

2.03 FASTENINGS

A. Fasteners: Of size and type to suit application; zinc plated finish in concealed locations and stainless steel finish in exposed locations.

B. Concealed Joint Fasteners: Threaded steel.

2.04 WOOD TREATMENT

A. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

2.05 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Shop prepare and identify components for book match grain matching during site erection.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install hardware in accordance with manufacturer's instructions.

3.02 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Board insulation at perimeter foundation wall.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 07 26 40: Spray Polyurethane Foam Insulating Air Barrier: Insulation Type 2.

B. Section 07 53 00 - Elastomeric Membrane Roofing: Insulation specified as part of roofing system.

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2011be1.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene board.

2.02 FOAM BOARD INSULATION MATERIALS

A. Insulation Type 1: Extruded Polystyrene Board Insulation: ASTM C578, Type X; Extruded polystyrene board with natural skin surfaces; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Perimeter foundation wall insulation.
   3. Board Size: 24 x 96 inch.
   4. Board Thickness: 2 inches.
   5. Board Edges: Square.
   6. Compressive Resistance: 25 psi.
   7. Manufacturers:
      a. Dow Chemical Co: www.dow.com.
      b. Owens Corning Corp: www.owenscorning.com.

8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation Type 2: See Section 07 26 40: Spray Polyurethane Foam.

2.03 BATT INSULATION MATERIALS

A. Insulation Type 3 and 4: Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Insulation at cold formed metal framing, eaves and soffits.
   2. Thickness: 6 inch.
   3. Facing: Type 3 - Unfaced; Type 4 - Aluminum foil, flame spread <25, one side.
   4. Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com.
      b. Johns Manville Corporation: www.jm.com.
      c. Owens Corning Corp: www.owenscorning.com.

B. Insulation Type 5: Acoustical (Not Used)

C. Insulation Type 6: Flexible mineral fiber preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Fire safing insulation.
   2. Manufacturers:
      a. Thermafiber, Inc: www.thermafiber.com.

2.04 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

B. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, or irregularities.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.
   1. Install in running bond pattern.
   2. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Extend boards over expansion joints, unbonded to foundation on one side of joint.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Tape insulation batts in place.

G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

H. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

I. Tape seal tears or cuts in vapor retarder.

J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 26 40

SPRAY POLYURETHANE FOAM INSULATING AIR BARRIER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. This section includes the following:
   1. Materials and installation to bridge and seal the following air leakage pathways and gaps:
      a. Connections of the walls to the roof air barrier.
      b. Connections of the walls to the foundations.
      c. Seismic and expansion joints.
      d. Openings and penetrations of window frames, store front, curtain wall.
      e. Barrier envelope systems.
      f. Door frames.
      g. Piping, conduit, duct and similar penetrations
      h. Masonry ties, screws, bolts and similar penetrations.
      i. All other air leakage pathways in the building envelope.
      j. Materials to act as flashings and counterflashings.

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Sheet metal flashings to be built into masonry are furnished under Section 07 62 00.

1.03 RELATED SECTIONS

A. Section 04 20 00 - Unit Masonry:
   1. Masonry backup walls
   2. Masonry veneer cavity walls.

B. Section 07 21 00 - Building Insulation: Insulation with integral vapor retarder facing.

C. Section 07 90 00 - Joint Sealers: Joint sealant materials and installation.

D. Section 08 11 13: Door frames.

E. Section 08 43 13 Aluminum storefronts and entrances

1.04 PERFORMANCE REQUIREMENTS

A. Provide air/vapor barrier system constructed to perform as a continuous air/vapor barrier system, as building thermal insulation, and as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration. System shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air seal materials at such locations, changes in substrate and perimeter conditions.

B. Maximum Permissible Air Leakage Rates cfm/sf @ 0.3" w.g. (l/s.m2 @ 75 Pa)
   1. 0.02 (0.1)

1.05 SUBMITTALS

A. Provide submittals in accordance with Section 01 30 00.

1. Submit shop drawings showing locations and extent of air/vapor barrier and details of all typical conditions, intersections with other envelope systems and materials, membrane flashings and counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated and how miscellaneous penetrations such as conduits, pipes electric boxes and the like are sealed.
2. Submit manufacturer's product data sheets for each type of material, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
3. Submit manufacturer's installation instructions.
4. Provide evidence of testing by an accredited laboratory confirming material has been tested and conforms to the requirements of ASTM E2178, Standard for Air Barrier Materials.
5. Certification by air/vapor barrier manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
6. Certification of compatibility by air/vapor barrier manufacturer, listing all materials on the project that it connects to or that come in contact with it.
7. Submit two samples, 12 by 12 inch (300 by 300 mm) minimum size, of each air/vapor barrier material required for Project.
8. Submit test results of air permeability testing of primary air barrier material (ASTM E 2178-01).
9. For LEED requirements, provide evidence of a minimum 14.6% recycled content and minimum 2.8% rapidly-renewable content.
10. Provide evidence of testing by an accredited laboratory confirming material has been tested and conforms to the requirements of ASTM E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies: Pass.
11. Provide evidence of testing by an accredited laboratory confirming material has been tested and conforms to the requirements of NFPA 285: Pass.
12. Quality Assurance Program: Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification number of installers at time of submittal.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Each worker who is installing air barriers must be either a Certified Applicator or an installer who is registered with ABAA
   2. Each Lead Certified Applicator can supervise a maximum of five registered installers. The Certified Applicator shall be thoroughly trained and experienced in the installation of air barriers of the types being applied. Lead Certified Applicators shall perform or directly supervise all air/vapor barrier work on the project.
   3. Installers shall also be certified by ABAA/NECA (National Energy Conservation Association) and PSDI (Professional Skills Development Institute for energy conservation) and SPFA (Spray Polyurethane Foam Alliance as foam mechanics). Installers shall have their photo-identification certification cards in their possession and available on the project site, for inspection upon request.
   4. Provide products that comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
   5. Preconstruction Meeting: Convene one week prior to commencing Work of this section, in accordance with Section 01 20 00 - Project Meetings.

6. Cooperate and coordinate with the Owner's inspection and testing agency if required. Do not cover any installed air and vapor barrier unless it has been inspected, tested and approved per requirements.
7. Protect people and materials from over-spray and contact with chemicals and gases.

1.07 FIELD QUALITY ASSURANCE

A. Implement the ABAA Quality Assurance Program requirements. Cooperate with ABAA inspectors and independent testing and inspection agencies engaged by the Owner. Do not cover air barrier until it has been inspected, tested, and accepted.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, expiration date, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air/vapor barrier manufacturer. Protect stored materials from direct sunlight.

C. Avoid spillage. Immediately notify Owner, Architect if spillage occurs and start clean up procedures.

D. Clean spills and leave area as it was prior to spill.

1.09 WASTE MANAGEMENT AND DISPOSAL

A. Separate and recycle waste materials in accordance with Section 01 35 50 - Waste Management and Disposal, and with the Waste Reduction Workplan.

B. Place materials defined as hazardous or toxic waste in designated containers.

C. Ensure emptied containers are sealed and stored safely for disposal away from children.

1.10 PROJECT CONDITIONS

A. Environmental Conditions: Apply air/vapor barrier within range of ambient and substrate temperatures recommended by air/vapor barrier manufacturer. Do not apply air/vapor barrier to a damp or wet substrate, unless the manufacturer specifically permits that for the product.
   1. Do not apply air/vapor barrier in snow, rain, fog, or mist.
   2. Do not apply air/vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.
   3. The product shall not be installed after the expiry date printed on the label of each container. The product has a shelf life of 6 months from the date of manufacture.

1.11 WARRANTY

A. System Warranty: Provide the manufacturer's three year system warranty, including the primary air/vapor barrier and installed accessory sealant and membrane materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 MATERIALS & MANUFACTURERS

A. Sprayed polyurethane foam material, when tested, shall meet the requirements of ULC S705.1-01 Standard for Thermal Insulation-Spray Applied Rigid Polyurethane Foam, Medium Density, Material- Specification.

B. A copy of an Evaluation Report (such as the CCMC Evaluation Report) or copies of the test reports from an accredited testing laboratory, for each physical property, indicating that the product meets the requirements of ULC S705.1-01 shall be made available upon request.

C. Material containers shall be labeled with the Evaluation Report number of the evaluation agency.

D. Design R-value as indicated in test report; minimum R6.9/inch.

E. Density as indicated in test report: minimum 1.7 pounds per cubic foot.

F. Smoke development as indicated in test report; less than 500 when tested under ULC S102.

G. Products that meet the preceding requirements:
   1. Basis-of-design product: Walltite closed cell spray foam polyurethane air/vapor barrier as manufactured by BASF (215-966-1168).
   2. Or equal.

2.02 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended by air/vapor barrier manufacturer for intended use and compatible with the air/vapor barrier.

B. Transition Membrane: Self-adhering, smooth surfaced SBS modified bitumen membrane, nominal 40 mil thickness, width as required, to detail all rough openings, changes in material substrates, and penetrations.
   1. Blueskin SA as manufactured by Henry Company Inc
   2. Butyl-based peel and stick membrane: Transition between air/vapor barrier membrane and TPO or EPDM membranes:
      a. Blueskin SA as manufactured by Henry Company Inc.
   3. Primer: Water based liquid primer for concrete, masonry, gypsum sheathing, wood, metal, and painted substrates;
      a. Aquatac as manufactured by Henry Company Inc.
   4. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes approved by foamed in place air/vapor barrier manufacturer.
   5. Stainless-Steel Sheet Flashing: ASTM A167, Type 304, soft annealed, with No. 2D finish; minimum, 0.0156 inch (0.4 mm) thick.
   6. Transition Strip Primer:
      a. Blueskin Primer as manufactured by Henry Company Inc.
   7. Sheet Membrane Transition Strip Termination Sealant:
      a. BES 925 Sealant by Henry Company Inc.
   8. Sheet Membrane Sheet Membrane Air Barrier Perimeter Seal to Windows, Doors, Curtainwall and Storefront systems: Low modulus silicone sheet; provide manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit widths indicated, combined with a neutral-curing low modulus silicone sealant for bonding extrusions to substrates.
      a. Pecora Sil-Span.

b. Dow 1-2-3 or equal.

9. Provide sealants in accordance with Section 07 90 00 - Joint Sealers. Comply with ASTM C920 and ASTM C920 classifications for type, grade, class, and uses.
   a. Silicone Sealant Type A: natural cure, low modulus, to seal sheet membrane flashing to polyethylene face of sheet rubberized-asphalt barrier and to seal between and to non-bituminous sheet systems.
      1) Acceptable materials:
         (a) Dow 790
         (b) Pecora 864
      2) SPF (Sprayed Polyurethane Foam) Sealant: Provide one- or two-component, foamed-in-place, polyurethane foam sealant with the following characteristics:
         (a) Density: 1.5 to 2.0 PCF.
         (b) Flame Spread (ASTM E162): 25 or less.
         (c) Initial R-Value (at 1 inch): Not less than 7.
         (d) Acceptable materials:
            (1) Zerodraft Foam Sealant.
            (2) Zerodraft Insulating Air Sealant
            Zerodraft (Division of Canam Building Envelope Specialists Inc.), 125 Traders Blvd. E., Unit # 4, Mississauga, ON, L4Z 2H3 Tel. 1-877-272-2626
   b. Substrate Cleaner: Non-corrosive compatible with adjacent materials.

2.03 EQUIPMENT

A. The equipment used to spray the polyurethane foam material shall be in accordance with ULC S705.2-02 and the equipment manufacturer's recommendations for specific type of application.

B. Equipment settings are to be recorded on the Daily Work Record as required by the ULC S705.2-02 Installation standard.

C. Each proportioner unit to supply only one spray gun.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions under which air/vapor barrier systems will be applied, with Installer present, for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
   1. Ensure that:
      a. surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
      b. concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
      c. masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
      d. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
      e. Notify Architect in writing of anticipated problems using air/vapor barrier over substrate.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions.

Provide clean, dust-free, and dry substrate for air/vapor barrier application.

B. Prime ICBP metal substrates with conditioning primer when installing modified asphalt membrane transition membranes.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air/vapor barrier and at protrusions according to air/vapor barrier manufacturer's written instructions.
   1. Verify that surfaces and conditions are suitable to accept work as outlined in this section.
   2. Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.
   3. Examine joints before sealing to ensure configurations, surfaces and widths are suitable for spray polyurethane foam. Report in writing all defects stating the locations of joints deemed unacceptable for the application of the spray polyurethane foam.

3.03 PREPARATION

A. Protection:
   1. Mask and cover adjacent areas to protect from over spray.
   2. Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.
   3. Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.
   4. Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.
   5. Surface Preparation
      a. Surfaces to receive foam insulation shall be clean, dry and properly fastened to ensure adhesion of the polyurethane foam to the substrate.
      b. Ensure that all work by other trades that may penetrate through the air barrier system is in place and complete.
      c. Ensure that surface preparation and any primers required conform to the manufacturer's instructions.
      d. Prepare surfaces by brushing, scrubbing. Scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion and integrity of the spray polyurethane foam. Wipe down metal surfaces to remove release agents or other non-compatible coatings, using clean sponges or rags soaked in a solvent compatible with the spray polyurethane foam. Ensure surfaces are dry before proceeding.
      e. Install transition membranes around and into all rough openings, to all materials penetrating the exterior wall to all applicable surfaces and ensure proper adhesion of the transition membranes to the substrate, capable of having spray polyurethane foam insulation.
      f. Install counter-flashings”
         1) Metal: Mechanically fasten metal counter-flashings with screws at 8” (200 mm) o.c.
         2) Membrane: Cut into and uncover only 3” of siliconized release paper along one edge of the counter-flashing membrane. Adhere membrane flashing to the pre-primed substrate a minimum of 3” and roll firmly in place.
      g. Ensure veneer anchors are in place.

3.04 APPLICATION

A. Spray-application of polyurethane foam shall be installed in accordance with ULC S705.2-02 and the manufacturer's instructions.

B. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer and the ULC S705.2 Installation standard.

C. Apply in consecutive passes as recommended by manufacturer to thickness as indicated on drawings. Passes shall be not less than ½ inch and not greater than 2 inches.

D. Do not install spray polyurethane foam within 3 inches of heat emitting devices such as light fixtures and chimneys.

E. Finished surface of foam insulation to be free of voids and embedded foreign objects.

F. Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.

G. Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.

H. Clean and restore surfaces soiled or damaged by work of the section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work.

I. Do not permit adjacent work to be damaged by work of this section. Damage to work of this section caused by other sections shall be repaired by this section at the expense of the subcontractor causing the damage.

J. Complete connections to other components or repair any gaps, holes or other damage using material which conforms to ULC S710.1 Polyurethane Sealant Foam - One Component - Material or ULC S711.1 Polyurethane Sealant Foam - Two Components - Material and shall be installed in accordance with ULC S710.2 Polyurethane Sealant Foam - One component - Installation or ULC S711.2 Polyurethane Sealant Foam - Two Component - Installation, whichever is appropriate.

3.05 TOLERANCES

A. Maximum variation from indicated thickness: minus (-) ¼ inch; plus (+) ½ inch.

3.06 PROTECTION

A. Cover the spray polyurethane foam with a thermal barrier when installed on the interior of the building.

END OF SECTION

SECTION 07 26 16

UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

1.02 RELATED SECTIONS

A. Section 03300 Cast-in-place Structural Concrete

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM E 1745-97(2004) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
   2. ASTM E 154-99(2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
   3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials
   4. ASTM E 1643-98(2005) Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

1.04 SUBMITTALS

A. Quality Control / Assurance
   1. Independent laboratory test results showing compliance with ASTM & ACI Standards.
   2. Manufacturer's samples, literature
   3. Manufacturer's installation instructions for placement, seaming and pipe boot installation

PART 2 - PRODUCTS

2.01 MATERIALS

A. Vapor Barrier
   1. Vapor Barrier must have the following qualities
      a. Perm rating less than or equal to 0.01 perms (grains/(ft2 *hr * in. Hg)) after conditioning as tested by:
         1) ASTM E 96

B. Vapor Barrier Products
   1. Stego Wrap (15 mil) Vapor Barrier by STEGO INDUSTRIES LLC, San Clemente, CA (877) 464-7834 www.stegoindustries.com
   2. Griffolyn 15 mil Green Vapor Barrier by Reef Industries, Inc.
   3. VaporBlock 15 by Raven Industries, Inc.

C. ACCESSORIES
   1. Seam Tape
      a. Tape must have the following qualities:
         1) Water Vapor Transmission Rate ASTM E 96: 0.3 perms or lower

2. Vapor Proofing Mastic
   a. Mastic must have the following qualities:
      1) Water Vapor Transmission Rate ASTM E 96: 0.3 perms or lower
3. Pipe Boots
   a. Provide manufacturer's supplied pipe boot system or construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure that subsoil is approved by architect or geotechnical firm
   1. Level and tamp or roll aggregate, sand or tamped earth base.

3.02 INSTALLATION

A. Install Vapor Barrier/Retarder:
   1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643.
      a. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
      b. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
      c. Overlap joints 6 inches and seal with manufacturer's tape.
      d. Seal all penetrations (including pipes) per manufacturer's instructions.
      e. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.
      f. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION

SECTION 07 42 13

METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Manufactured metal panels for walls and soffits, with related flashings, and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Wall panel substrate.

B. Section 07 21 00 - Thermal Insulation.

C. Section 07 90 05 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage.

C. Samples: Submit two samples of wall panel and soffit panel, 12 inch by 12 inch in size illustrating finish color, sheen, and texture.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off ground and protected from weather. Prevent twisting, bending, or abrasion, and provide ventilation to stored materials. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a twenty year period after Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

C. Correct defective Work within a five year period after Substantial Completion, including defects in water tightness and integrity of seals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Centria; Product CS-200, 12 width wall panel.

B. Other Acceptable Manufacturers:
   1. MBCI: www.mbci.com.
   2. Metal Sales Manufacturing Corporation: www.metalsales.us.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior panels and soffit panels.
   2. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Maximum Allowable Deflection of Panel: 1/90 of span.
   4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   7. Corners: Factory-fabricated in one continuous piece with minimum 18 inch returns.
   8. Exterior Finish: Panel manufacturer's standard metalic 3-coat polyvinylidene fluoride (PVF) coating, top coat over epoxy primer.
   9. Exterior Panel Back Coating: Panel manufacturer's standard polyester wash coat.

B. Exterior Panels:
   1. Profile: Vertical.
   2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous bead of sealant.
   3. Material: Precoated steel sheet, minimum 22 gage thick.
   4. Panel Width: 12 inches.
   5. Color: As selected by Architect from manufacturer's metalic 3-coat line.

C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; brake formed to required angles.

D. Expansion Joints: Same material, thickness and finish as exterior sheets; 24 gage; manufacturer's standard brake formed type, of profile to suit system.

E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

F. Anchors: Galvanized steel or Stainless steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Sealants: As specified in Section 07 90 05.

C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized.

D. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

3.02 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports. Lap panel ends minimum 2 inches.

E. Provide expansion joints where indicated.

F. Use concealed fasteners unless otherwise approved by Architect.

G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.04 CLEANING

A. Remove site cuttings from finish surfaces.

B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 53 00

ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Elastomeric roofing membrane, adhered conventional application.

C. Insulation, flat and tapered.

D. Flashings.

E. Roofing stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings.

1.03 REFERENCE STANDARDS

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2012.

B. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2012.

C. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011.

D. FM DS 1-28 - Wind Design; Factory Mutual Research Corporation; 2007.

E. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

F. UL (RMSD) - Roofing Materials and Systems Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
   1. LEED Submittal: Include testing documentation of solar reflectance index.

C. Shop Drawings: Indicate joint or termination detail conditions and conditions of interface with other materials.

D. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

E. Manufacturer's Field Reports: Indicate procedures followed and supplementary instructions given.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 95 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials:
   1. Basis of Design: Carlisle SynTec; Sure-White EPDM: www.carlisle-syntec.com.
   2. Firestone Building Products Co: www.firestonebpco.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation:
   1. Atlas Roofing Corporation: www.atlasroofing.com.
   2. Basis of Design: Carlisle SynTec.

2.02 ROOFING

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Requirements:
   1. Solar Reflectance Index (SRI): 78, minimum, calculated in accordance with ASTM E1980, based on 3-year aged data.
      a. Field applied coating may not be used to achieve specified SRI.
   2. Roof Covering External Fire-Resistance Classification: UL Class A.
   3. Factory Mutual Classification: Class I and windstorm resistance of I-90, in accordance with FM DS 1-28.

C. Acceptable Insulation Types - Constant Thickness Application: Any of the types specified.
   1. Minimum 2 layers of polyisocyanurate board.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); non-reinforced; complying with minimum properties of ASTM D 4637.
   1. Thickness: 0.060 inch.
   2. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Same material as membrane; conforming to the following:
   1. Thickness: 90 mil.
   2. Tensile Strength: 1,200 psi.
   3. Elasticity: 50 percent with full recovery without set.
   4. Color: White.

2.04 INSULATION

A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 1 and with the following characteristics:
   1. Compressive Strength: 16 psi
   2. Board Size: 48 x 96 inch.
   3. Thermal Resistance: R-value of 20.1.
   4. Board Edges: Square.
   5. Manufacturer: as approved by membrane manufacturer.

2.05 COVER BOARD

A. Fiberglass Mat Gypsum Roof Board:
   1. Manufacturer: Georgia Pacific; Product: DensDeck Prime.
   2. Thickness: 1/2 inch.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed-cell foam backing seamed to galvanized steel flanges.

B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

E. Membrane Adhesive: As recommended by membrane manufacturer.

F. Insulation Adhesive: As recommended by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and nailing strips are in place.

3.02 METAL DECK PREPARATION

A. Install preformed sound absorbing glass fiber insulation strips in acoustic deck flutes. Install in accordance with manufacturer's instructions.

3.03 INSULATION - UNDER MEMBRANE

A. Attachment of Insulation: Mechanically fasten each layer of insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.

C. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

D. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

E. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

F. Do not apply more insulation than can be covered with membrane in same day.

3.04 MEMBRANE APPLICATION

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at manufacturer's required rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Install roofing expansion joints where indicated. Make joints watertight.

1. Install prefabricated joint components in accordance with manufacturer's instructions.

H. Coordinate installation of roof drains and related flashings.

I. Install oil resistant ECO/CO roof membrane overlay within 10 feet of kitchen exhaust systems.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.

B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.

3.06 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Fabricated sheet metal items, including flashings and counterflashings.

C. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Through-wall flashings in masonry.

B. Section 07 53 00 - Elastomeric Membrane Roofing: Roofing system.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2011.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.

D. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples 6 x 6 inch in size illustrating metal finish color.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 FLASHING TYPES

A. Flashing Type 1: 2 piece interlocking type. Not Used.

B. Flashing Type 2: Masonry thru-wall type: Refer to Section 04 20 00, Unit Masonry.

C. Flashing Type 3: Roofing base flashing type: Refer to Section 07 53 00, Elastomeric Membrane Roofing.

D. Flashing Type 4: Formed metal flashing (other than Type 1): Materials and locations specified below.

2.02 SHEET MATERIALS (FLASHING TYPE 4)

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; metalic 3-coat, thermally cured fluoropolymer finish system.
   2. Color: To match sheet metal roofing.
   3. Location: Trim and flashing around metal roofing, as shown on Drawings.

2.03 ACCESSORIES

A. Fasteners: Stainless steel.

B. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D 1970; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.

C. Primer: Zinc chromate type.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Sealant: Type 1 specified in Section 07 90 05.

F. Plastic Cement: ASTM D4586, Type I.

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

END OF SECTION

SECTION 07 71 00

ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Manufactured roof specialties, including copings and fascias.

C. Roof control and expansion joint covers.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2011.

B. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

C. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; Single Ply Roofing Industry; 2003. (ANSI/SPRI ES-1)

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Samples: Submit two appropriately sized samples of coping and gravel stop.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual details.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Roof Edge Flashings and Copings:
   1. Basis of Design: W.P. Hickman Company; Extruded TerminEdge: www.wph.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Control and Expansion Joint Covers:
   1. GAF Materials Corporation: www.gaf.com.
   2. Johns Manville Corporation: www.jm.com.
   3. MM Systems Corp: www.mmsystemscorp.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
   1. Configuration: Fasciaand edge securement for roof membrane;
   2. Pull-Off Resistance: Tested in accordance with SPRI ES-1 RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable code.
   3. Material: Extruded aluminum, 0.08 inch thick, minimum.
   4. Finish: 70 percent polyvinylidene fluoride.
   5. Color: To match sanding seam metal roofing.
   6. Products:
      a. W.P. Hickman Company; Extruded TerminEdge: www.wph.com.

B. Copings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
   1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
   2. Pull-Off Resistance: Tested in accordance with SPRI ES-1 RE-3 to positive and negative design wind pressure as defined by applicable code.

C. Control and Expansion Joint Covers: Composite construction of 6 inch wide flexible EPDM flashing of white color with closed cell urethane foam backing, each edge seamed to stainless steel sheet metal flanges, designed for nominal joint width of 1 inch. Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.

2.03 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; metalic 3-coat, thermally cured fluoropolymer finish system; color as scheduled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

C. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Manufactured curbs, equipment rails, and pedestals.

C. Roof hatches.

1.02 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

B. Section 07 71 00 - Roof Specialties: Other manufactured roof items.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURED CURBS

A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.
   1. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
   2. Provide the layouts and configurations shown on the drawings.

2.02 ROOF HATCHES

A. Manufacturers - Roof Hatches:
   1. Basis of Design: Bilco Company; Type S (ladder access, standard size, solid cover): www.bilco.com.

2. Dur-Red Products: www.dur-red.com.
3. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Roof Hatches: Factory-assembled steel frame and cover, complete with operating and release hardware.
1. Style: Provide flat metal covers unless otherwise indicated.
2. Mounting: Provide frames and curbs suitable for mounting conditions indicated on the drawings.

C. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
1. Material: Galvanized steel, 14 gage, 0.0747 inch thick.
2. Finish: Factory prime paint.
3. Insulation: 1 inch rigid glass fiber, located on outside face of curb.
4. Curb Height: 12 inches from finished surface of roof, minimum.

D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch thick, liner 22 gage, 0.03 inch thick.
3. Finish: Factory prime paint.
4. Insulation: 1 inch rigid glass fiber.
5. Gasket: Neoprene, continuous around cover perimeter.

E. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
2. Hinges: Heavy duty pintle type.
3. Hold open arm with vinyl-coated handle for manual release.
4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 84 13

HVAC & PLUMBING PENETRATION FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section includes:

1. Through-penetration firestopping in fire rated construction.

2. Through-penetration smoke-stopping in smoke partitions.

C. Related items:

1. Fire dampers and manufactured devices: Refer to Division 23 Section *HVAC Air Distribution*.

2. Smoke dampers and combination fire/smoke dampers. Refer to Division 23 Section *HVAC Air Distribution*.

1.02 REFERENCES

A. Underwriters Laboratories

1. UL Fire Resistance Directory

a. Through-penetration firestop devices (XHCR)

b. Fire resistance rating (BXUV)

c. Through-penetration firestop systems (XHEZ)

d. Fill, void, or cavity material (XHHW)

B. American Society for Testing and Materials Standards:

1. ASTM E 814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.03 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time-rated fire walls, smoke barrier walls, time-rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

F. Sleeve: Metal fabrication or pipe section extended through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.04 SYSTEM DESCRIPTION

A. Design Requirements

1. Fire-rated construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations.

2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations.

1.05 SUBMITTALS

A. Submit in accordance with Division 01 Section *Submittal Procedures*, unless otherwise indicated.

B. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.

2. Manufacturer's installation instructions.

C. Shop drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable UL system number, or UL classified devices.

2. Manufacturer or manufacturer's representative shall provide qualified engineering judgment and drawings relating to non-standard applications as needed.

D. Quality control submittals:

1. Statement of qualifications.

E. Applicators' qualifications statement:

1. List past projects indicating required experience.

1.06 QUALITY ASSURANCE

A. Installer's qualifications: Fire experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, State or local authority where applicable.

2. At least 2 years experience with systems.

3. Successfully completed at least 5 comparable scale projects using this system.

B. Local and State regulatory requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL Firestop System numbers, or UL classified devices.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

D. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.

2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.08 PROJECT CONDITIONS

A. Existing condition:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:

1. Furnish adequate ventilation if using solvent.

2. Furnish forced air ventilation during installation if required by manufacturer.

3. Keep flammable materials away from sparks or flame.

4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

1.09 WARRANTY

A. Submit copies of written warranty agreeing to repair or replace joint sealers which fail in joint adhesion, extrusion resistance, migration resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The warranty period shall be two (2) years from date of substantial completion unless otherwise noted.

PART 2 PRODUCTS

2.01 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems of devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the UL system or device, and designed to perform this function.

2. Acceptable manufacturers and products.

a. Those listed in the UL Fire Resistance directory for the UL System involved and as further defined in the System and Applications Schedule in Part 3.6 of this section.

3. All firestopping products must be from a single manufacturer. All trades shall use products from the same manufacturer unless otherwise noted.

2.02 SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified in The Systems and Applications Schedule in Part 3.6 of this section, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.03 ACCESSORIES

A. Fill, void or cavity materials: As classified under category XHHW in the UL Fire Resistance Directory.

B. Forming materials: As classified under category XHKU in the UL Fire Resistance Directory.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.

2. Do not proceed until unsatisfactory conditions have been corrected.

B. Coordinate an inspection of all Mechanical Firestopping systems with the Fire Marshal prior to installation of ceilings, walls, etc.

3.02 PREPARATION

A. Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.03 INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.

B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

C. Protect materials from damage on surfaces subject to traffic.

D. When large openings are created in walls or floors to permit installation of pipes, ducts, or other items, close unused portions of opening with firestopping materials tested for the application. See UL Fire Resistance Directory or Section 3.6 of this document.

E. Install smoke stopping as specified for firestopping.

3.04 FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

3.05 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.06 SYSTEMS AND APPLICATION SCHEDULES*

PENETRATING ITEM	CONCRETE	GYPSUM	WOOD FLOOR/CEILING
Metal Pipe	CAJ1001 CP25S/L, CP25N/S CAJ1006 CS-195+, FS-195+ CAJ1007 FS-195+, 1-inch& 2-inch Wide CAJ1009 2000, 2000+, 2003 CAJ1010 2000, 2000+, 2003 CAJ1012 2000, 2000+, 2003 CAJ1013 2000, 2000+, 2003 CAJ1014 2000, 2000+, 2003 CAJ1015 2000, 2000+, 2003 CAJ1017 FD 150 CAJ1021 FD 150 CAJ1027 MPS-2+ CAJ1044 CP 25WB+ CAJ1052 CP 25S/L, CP 25N/S CAJ1058 2000, 2000+, 2003 CAJ1060 2000, 2000+, 2003 CAJ1063 2000, 2000+, 2003 CAJ1066 CP 25N/S,CP 25S/L, CP 25WB+ CAJ1091 CP 25N/S,CP 25S/L, CP 25WB+ CAJ1092 CP 25WB+ CAJ1112 FS-195+ CAJ1160 CP 25S/L, CP 25N/S CAJ1175 CP 25WB+ CAJ1176 CP 25WB+ CAJ1188 2000+ CBJ1020 CS-195+, FS-195+ CBJ1021 CS-195+, MPS-2+ CBJ1031 2001 CBJ1032 2001 FA1002 CP 25WB+ WJ1010 CP25WB+ WJ1023 2001	WL1001 CP 25 WL1002 FS-195+ WL1003 CP 25WB+,CP 25N/S WL1008 2000+ WL1009 2000+ WL1010 2000+ WL1016 CP 25WB+ WL1017 CP 25WB+,CP 25N/S WL1032 CP 25WB+,CP 25N/S WL1036 FD 150 WL1037 CS-195+,FS-195+ WL1067 CP 25N/S WL1073 CP 25WB+ WL1080 MPS2+ WL1082 2000+	FC1002 CP 25 FC1003 2000,2000+,20003 FC1006 CP 25WB+
Non-Metallic	CAJ2001 FS-195+, 1-inch& 2-inch WIDE, PPD'S CAJ2002 FS-195+ CAJ2003 CS-195+, FS-195+ CAJ2005 FS-195 CAJ2006 FS-195+ CAJ2013 FS-195+ CAJ2019 2000, 2000+, 2003 CAJ2027 FS-195+, CP 25N/S, CP 25S/L, CP 25WB+ CAJ2028 FS-195, MPS-2+ CAJ2029 FS-195+, PPD'S CAJ2030 CS-195+, FS-195+ CAJ2040 FS-195+, CP 25WB+ CAJ2044 FS-195+, CP 25N/S, CP 25S/L CP 25 WB+ CAJ2090 FS-195+ CAJ2177 FS-195+, PPD'S FA2001 FS-195+, PPD'S FS2002 CS-195+, FS-195+, MPS-2+, PPD'S FA2011 FS-195+ WJ2012 FS-195+ 1-inch WIDE	WL2002 FS-195+, PPD'S WL2003 FS-195+ WL2004 FS-195+ WL2005 FS-195+ 4' WIDE WL2006 FS-195+ WL2013 FS-195+ WL2031 CS-195+, FS-195+ WL2032 CS-195+, FS-195+ WL2033 FS-195+ WL2073 FS-195+ 1-inch WIDE	FC2002 FS-195+, PPD'S FC2007 FS-195+, PPD'S FC2008 FS-195+ FC2009 FS-195+, PPD'S FC2024 FS-195 FC2026 FS-195+ FC2028 FS-195, 1' & 2-inch WIDE, PPD'S

PENETRATING ITEM	CONCRETE	GYPSUM	WOOD FLOOR/CEILING
Insulated Metallic Pipe	CAJ5001 CP 25N/S, CP 25S/L, CP 25WB+ CAJ5002 FS-195+ CAJ5003 FS-195+ CAJ5005 MPS-2+ CAJ5009 2000+, 2003 CAJ5017 FS-195+, CP 25 CAJ5022 FS-195+ CAJ5024 FS-195+ CAJ5030 CS-195+, FS-195+ CAJ5041 2000, 2000+, 2003 CAJ5060 CP 25WB+ CAJ5074 2000+ CBJ5002 CP 25 CBJ5003 FS-195+ FA5001 FS-195+, CP 25WB+	WL5001 FS-195+ WL5002 FS-195+ WL5009 FS-195+ WL5010 FS-195+ WL5011 CP 25WB+ WL5032 2000+ WL5038 CP 25WB+ WL5039 CP 25WB+ WL5040 CP 25WB+ WL5045 CP 25WB+ WL5053 2000+	FC5002 FS-195+ FC5008 FS-195+
Miscellaneous Mechanical HVAC Ducts	CAJ7001 CP 25N/S CP 25S/L CAJ7003 CP 25WB+ CAJ7009 DUCT WRAP, BULK PUTTY		FC7001 CP 25S/L, CP 25N/S
Mixed Penetrating Items Combos	CAJ8001 CS-195+ FS-195 CAJ8003 2000, 2000+, 20003 CAJ8004 2000, 2000+, 20003 CAJ8006 2001 CAJ8013 FS-195+, CP 25 CBJ8004 CS-195, FS-195+ CBJ8005 CS-195+, MPS-2+ CBJ8008 2001 FA8001 FS-195+, CP 25WB+	WL8002 CS-195+, FS-195+	

* Underwriter's Laboratories, Inc., Fire Resistance Directory.

END OF SECTION

SECTION 07 90 05

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Sealants and joint backing.

C. Precompressed foam sealers.

1.02 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2010.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2011a.

D. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell); 2005 (Reapproved 2011).

E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. LEED Report: Submit VOC content documentation for all non-preformed sealants and primers.

D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.05 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.06 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Type 1 - General Purpose Exterior Sealant: Silicone; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Color: To be selected by Architect from manufacturer's full range.
   2. Joint Movement Range: +/- 50 percent.
   3. Product:
      a. SilPruf NB SCS9000 manufactured by Momentive Performance Materials, Inc (formerly GE Silicones).
      b. 890FTS manufactured by Pecora Corporation.
      c. 890FTS TXTR manufactured by Pecora Corporation.
      d. 795 manufactured by Dow Corning.
   4. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Joints in manufactured masonry veneer system.

C. Type 2 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Colors as selected.
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.

D. Type 3 - Coal tar extended, fuel resistant polyurethane sealant: Not Used.

E. Type 4 - Fire Resistant Foam Sealant:
   1. Manufacturers:
      a. Dow Corning: Product: 3-6548 RTV Foam.

F. Type 5 - Exterior Expansion Joint Sealer: Not Used

G. Type 6 - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
   1. Applications: Use for:
      a. Joints between plumbing fixtures and floor and wall surfaces.
      b. Joints between kitchen and bath countertops and wall surfaces.

H. Type 7 - Butyl Sealant: Not Used

I. Type 8 - Acpustical Sealant: Not Used.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; open cell polyurethane or reticulated (soft) polyethylene; oversized 33 to 50 percent larger than joint width; Denver Foam manufactured by Backer Rod Manufacturing, Inc.

D. Fire Rated Joint Filler: Pre-engineered, patened, flexible, textile fiberglass roll material with a fiberglass matt facing, containing approximately 30 percent by weight unexpanded vermiculite; Ultra Block manufactured by Backer Rod Manufacturing, Inc.

E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve the following:
   1. Width/depth ratio of 2:1.
      a. Minumim joint depth: 1/4 inch; Maximum joint depth: 1/2 inch, unless otherwise required by manufacturer.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

D. Install backer rod using blunt or rounded tool to a uniform (+/- 1/8 inch) depth without puncturingthe material.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

3.06 SCHEDULE

A. Exterior Joints for Which No Other Sealant Type is Indicated: Type 1; colors as selected.

B. Interior Joints for Which No Other Sealant is Indicated: Type 2; color as selected.

C. Penetrations of Fire Rated Construction: Type 1 with Ultra Block joint filler or Type 4.

D. Joints Between Plumbing Fixtures and Walls and Floors, and Between Countertops and Walls: Type 6.

END OF SECTION

SECTION 080671

DOOR HARDWARE SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Section 08 11 13 - Hollow Metal Doors and Frames.
2. Section 08 14 16 - Flush and Clad Wood Doors.
3. Section 08 14 33 - Stile and Rail Wood Doors.
4. Section 08 17 00 - Integrated Door Opening Assemblies.
5. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.
6. Section 08 42 26 - All-Glass Entrances.
7. Section 08 71 00 - Door Hardware.
8. Section 08 71 13 - Automatic Door Operators.
9. Section 08 74 00 – Access Control Hardware.
10. Section 28 13 00 – Access Control.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. [State Building Codes, Local Amendments].

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system

explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum [5] years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum [3] years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum [5] years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the applicable model building code.

F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets at the end of Part 3 of each referenced section that products are to supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

    a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.3 FINISHES

A. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S. finishes shown by certain manufacturers for their products.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products as listed in the door hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Products listed in the Door Hardware Sets are to be provided under and meet the requirements described in the specification sections noted.

1. Section 08 71 00 – Door Hardware.
2. Section 08 74 00 – Access Control Hardware.

D. Manufacturer's Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. SA - Sargent
4. BE - Stanley Security Solutions Inc (BE)
5. RF - Rixson
6. PE - Pemko
7. SU - Securitron
8. 00 - Other

Hardware Schedule

Set: 00.15.10
Doors: F116, FH110

2	Continuous Hinge	MCK-12HD SER-12 x LAR	CL	MK
1	Removable Mullion	L980S	PC	SA
1	Exit Device	16 55 56 8804 FLL LC	US32D	SA
1	Exit Device	16 55 8810 FLL	US32D	SA
4	Cylinder	1E-72/1E-74	626	BE
2	Door Closer	351 P10	EN	SA
2	Mop Plate	K1050 10" x 1" LDW 4BE	US32D	RO
2	Door Stop	471 EXP	US26D	RO
1	Threshold	271A x LAR MSES25SS		PE
1	Gasketing	S88D (Head & Jambs)		PE
1	Rain Guard	346C		PE
2	Sweep	3452CNB x LAR		PE
2	eLynx Frame Harness	QC-C1500P		MK
2	eLynx Door Harness	QC-C*** (Length / Type as Required)		MK
1	Power Supply	BPS (size & type as required)		SU
1	Wiring Diagram	Complete with point to point drawing		OT

Notes: A valid credential at the card reader (specified elsewhere) retracts the latches on the active door exit device allowing entry. Key override. Free egress at all times.

Set: 00.25.10
Doors: FH114, FH117

1	Continuous Hinge	MCK-12HD x LAR	CL	MK
1	Continuous Hinge	MCK-12HD SER-12 x LAR	CL	MK
1	Flush Bolt	2842	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Fail Secure Electric Lock	RX 8271-24V LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Coordinator	1700	Black	RO
2	Door Closer	351 P10	EN	SA
2	Mop Plate	K1050 10" x 1" LDW 4BE	US32D	RO
2	Door Stop	471 EXP	US26D	RO
1	Threshold	271A x LAR MSES25SS		PE
1	Gasketing	S88D (Head & Jambs)		PE
1	Rain Guard	346C		PE
1	Sweep	3452CNB x LAR		PE
1	Astragal	357SP		PE
1	eLynx Frame Harness	QC-C1500P		MK
1	eLynx Door Harness	QC-C*** (Length / Type as Required)		MK
1	Power Supply	BPS (size & type as required)		SU
1	Wiring Diagram	Complete with point to point drawing		OT

Notes: Valid credential at reader momentarily releases the fail secure lockset allowing entry. Key override. Free egress at all times. If it is determined that access control isn't used at this time, change lock model to 8225 LNL.

Set: 00.25.66
Doors: FH200, FH207A, FH208

1	Continuous Hinge	MCK-12HD SER-12 x LAR	CL	MK
1	Fail Secure Electric Lock	RX 8271-24V LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Door Closer	351 CPSH	EN	SA
1	Kickplate	K1050 10" x 2" LDW 4BE	US32D	RO
1	Threshold	271A x LAR MSES25SS		PE
1	Gasketing	S88D (Head & Jambs)		PE
1	Rain Guard	346C		PE
1	Sweep	3452CNB x LAR		PE
1	eLynx Frame Harness	QC-C1500P		MK
1	eLynx Door Harness	QC-C*** (Length / Type as Required)		MK
1	Power Supply	BPS (size & type as required)		SU
1	Wiring Diagram	Complete with point to point drawing		OT

Notes: Valid credential at reader momentarily releases the fail secure lock allowing entry. Key override. Free egress at all times. If it is determined that access control isn't used at this time, change lock model to 8225 LNL.

Set: 25.04.07
Doors: FH106, FH130A, FH130B, FH135

6	Hinge	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
2	Manual Flush Bolt	555	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom Lock	8204 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
2	Surface Overhead Holder/Stop	9ADJ-026	630	RF
2	Mop Plate	K1050 10" x 1" LDW 4BE	US32D	RO
1	Threshold	271A x LAR MSES25SS		PE
1	Gasketing	S88D (Head & Jambs)		PE
1	Rain Guard	346C		PE
2	Sweep	3452CNB x LAR		PE
1	Astragal	357SP		PE

Set: 25.04.66
Doors: FH136, FH402, FH404, FH406, FH408

3	Hinge	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Storeroom Lock	8204 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Door Closer	351 CPSH	EN	SA
1	Kickplate	K1050 10" x 2" LDW 4BE	US32D	RO
1	Threshold	271A x LAR MSES25SS		PE
1	Gasketing	S88D (Head & Jambs)		PE
1	Sweep	3452CNB x LAR		PE

Set: 25.25.66
Doors: FH105A, FH108, FH109, FH134A, FH137, FH138, FH205A, FH301A, FH301B

3	Hinge	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Dormitory Lock	8225 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Door Closer	351 CPSH	EN	SA
1	Kickplate	K1050 10" x 2" LDW 4BE	US32D	RO
1	Threshold	271A x LAR MSES25SS		PE
1	Gasketing	S88D (Head & Jambs)		PE
1	Rain Guard	346C		PE
1	Sweep	3452CNB x LAR		PE

Set: 25.64.16

Doors: FH101, FH103

6	Hinge	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
2	Flush Bolt	2842	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Mortise Deadlock	4877 LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
2	Door Pull	111	US32D	RO
2	Push Plate	70F CFC	US32D	RO
1	Coordinator	1700	Black	RO
2	Door Closer	351 P10	EN	SA
2	Mop Plate	K1050 10" x 1" LDW 4BE	US32D	RO
2	Door Stop	471 EXP	US26D	RO
1	Threshold	271A x LAR MSES25SS		PE
1	Gasketing	S88D (Head & Jambs)		PE
2	Sweep	3452CNB x LAR		PE
1	Astragal	357SP		PE

Set: 25.64.60
Doors: FH131, FH133

3	Hinge	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Deadlock	4877 LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Door Pull	111	US32D	RO
1	Push Plate	70F CFC	US32D	RO
1	Door Closer	351 O/P9	EN	SA
1	Kickplate	K1050 10" x 2" LDW 4BE	US32D	RO
1	Door Stop	471 EXP	US26D	RO
1	Threshold	271A x LAR MSES25SS		PE
1	Gasketing	S88D (Head & Jambs)		PE
1	Sweep	3452CNB x LAR		PE

Set: 45.13.10
Doors: FH115B

2	Continuous Hinge	MCK-12HD x LAR	CL	MK
1	Exit Device	16 NB8743 ETL LC	US32D	SA
1	Exit Device	16 NB8740 ETL LC	US32D	SA
3	Cylinder	1E-72/1E-74	626	BE

2	Door Closer	351 P10	EN	SA
2	Mop Plate	K1050 10" x 1" LDW 4BE	US32D	RO
2	Door Stop	409	US32D	RO
2	Silencer	608		RO

Set: 45.13.60
Doors: FH115A

1	Continuous Hinge	MCK-12HD x LAR	CL	MK
1	Exit Device	16 8843 ETL LC	US32D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Door Closer	351 P10	EN	SA
1	Kickplate	K1050 10" x 2" LDW 4BE	US32D	RO
1	Door Stop	409	US32D	RO
3	Silencer	608		RO

Set: 55.04.50
Doors: FH102, FH118, FH132, FH202, FH206

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	8204 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Kickplate	K1050 10" x 2" LDW 4BE	US32D	RO
1	Door Stop	409	US32D	RO
3	Silencer	608		RO

Set: 55.04.57
Doors: FH104

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	8204 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Surface Overhead Holder/Stop	9ADJ-026	630	RF
1	Kickplate	K1050 10" x 2" LDW 4BE	US32D	RO
3	Silencer	608		RO

Set: 55.37.10
Doors: FH111A, FH119A

2	Continuous Hinge	MCK-12HD x LAR	CL	MK

1	Flush Bolt	2842	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Classroom Lock	8237 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Coordinator	1700	Black	RO
2	Door Closer	351 P10	EN	SA
2	Mop Plate	K1050 10" x 1" LDW 4BE	US32D	RO
1	Door Stop	409	US32D	RO
1	Door Stop	471 EXP	US26D	RO
2	Silencer	608		RO

Set: 55.37.50
Doors: FH112, FH204, FH212

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	8237 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Door Stop	409	US32D	RO
3	Silencer	608		RO

Set: 55.37.57
Doors: FH107, FH223

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	8237 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Surface Overhead Holder/Stop	9ADJ-026	630	RF
3	Silencer	608		RO

Set: 55.37.60
Doors: FH203, FH211

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	8237 LNL LC	US26D	SA
1	Cylinder	1E-72/1E-74	626	BE
1	Door Closer	351 O/P9	EN	SA
1	Kickplate	K1050 10" x 2" LDW 4BE	US32D	RO
1	Door Stop	409	US32D	RO
3	Silencer	608		RO

Set: 55.99.10

Doors: FH111B, FH119B

2	Continuous Hinge	MCK-12HD x LAR	CL	MK
2	Door Pull	111	US32D	RO
2	Pull Plate	110x70C	US32D	RO
2	Door Closer	351 P10	EN	SA
2	Mop Plate	K1050 10" x 1" LDW 4BE	US32D	RO
2	Door Stop	409	US32D	RO
2	Silencer	608		RO

Set: 99.99.99

Doors: FH105B, FH105C, FH134B, FH134C, FH134D, FH134F, FH134H, FH206B, FH206C, FH207B, FH207C, FH207D, FH301C, FH301D, FH301E, FH301F

1	All Hardware by Door Supplier	00

END OF SECTION 080671

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Non-fire-rated steel doors and frames.

C. Thermally insulated steel doors.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

C. Section 09 90 00 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003.

C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2004).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

E. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

F. ASTM E1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

G. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

H. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:
   1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
   2. Republic Doors: www.republicdoor.com.
   3. Steelcraft: www.steelcraft.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   1. Accessibility: Comply with ANSI/ICC A117.1.
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   4. Door Texture: Smooth faces.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
   8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Exterior Doors:
   1. Grade: ANSI A250.8 Level 4, physical performance Level A, Model 2, seamless.
   2. Core: Polystyrene foam.
   3. Top Closures for Outswinging Doors: Flush with top of faces and edges.
   4. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
   5. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.

B. Interior Doors, Non-Fire-Rated:
   1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.
   2. Core: Cardboard honeycomb.
   3. Thickness: 1-3/4 inches.

2.04 STEEL FRAMES

A. General:
   1. Comply with the requirements of grade specified for corresponding door, except:
      a. ANSI A250.8 Level 4 Doors: 12 gage frames.
   2. Finish: Same as for door.
   3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
   4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
   5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

B. Exterior Door Frames: Fully welded.
   1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
   2. Weatherstripping: Separate, see Section 08 71 00.

C. Interior Door Frames, Non-Fire-Rated: Fully welded type.

2.05 ACCESSORY MATERIALS

A. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.
   1. Style: Sightproof inverted V blade.

B. Glazing: As specified in Section 08 80 00.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Astragals for Double Doors: Specified in Section 08 71 00.
   1. Exterior Doors: Steel, Z-shaped.

E. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

F. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

G. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. Coordinate frame anchor placement with wall construction.

C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

D. Coordinate installation of hardware.

E. Coordinate installation of glazing.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Test sound control doors for force to close, latch, and unlatch in accordance with ASTM E1408; adjust as required to comply.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Insulated service doors.

B. Related Sections:
   1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.
   2. Section 083333 “Coiling Counter Doors” for coiling counter doors.
   3. Section 083326 “Overhead Coiling Grilles” for open-curtain overhead coiling grilles.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
   1. Wind Loads:
      a. Basic Wind Speed: 95 mph.
   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

D. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   3. For fire-rated doors, description of fire-release system including testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Curtain Slats: 12 inches long.

E. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Summary of forces and loads on walls and jambs.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and professional engineer.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.01 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.
   2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
   3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.

B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.02 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.

2.03 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   1. Lock Cylinders: Provide cylinders specified in Section 087100 "Door Hardware" and keyed to building keying system.
   2. Keys: Provide three for each cylinder.

B. Chain Lock Keeper: Suitable for padlock.

C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.04 CURTAIN ACCESSORIES

A. Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.

B. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
   1. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
   2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

C. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.05 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.06 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   1. Comply with NFPA 70.
   2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.
   1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.

D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 110513 "Common Motor Requirements for Equipment" unless otherwise indicated.
   1. Electrical Characteristics:
      a. Phase: Single phase.
      b. Volts: 115/230 V.
      c. Hertz: 60.
   2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
   3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
   4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
   5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
   a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
   1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

K. Radio-Control System: Consisting of the following:
   1. Three-channel universal coaxial receiver to open, close, and stop door; one per operator.
   2. Remote-antenna mounting kit.

2.07 INSULATED DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; 625 Series Insulated Service Door or comparable product by one of the following:
      a. C.H.I. Overhead Doors.
      b. Cookson Company.
      c. Cornell Iron Works, Inc.

B. Operation Cycles: Not less than 20,000.
   1. Include tamperproof cycle counter.

C. Curtain R-Value: 7.7 deg F x h x sq. ft./Btu.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
   1. Insulated-Slat Interior Facing: Metal.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

G. Hood: Match curtain material and finish.
   1. Shape: Round.

2. Mounting: Face of wall.

H. Locking Devices: Equip door with locking device assembly and chain lock keeper.
1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside and outside with cylinders.

I. Electric Door Operator:
1. Usage Classification: Medium duty, up to 15 cycles per hour.
2. Operator Location: Top of hood.
3. Motor Exposure: Interior.
4. Emergency Manual Operation: Chain type.
5. Obstruction-Detection Device: Automatic pneumatic sensor edge on bottom bar ; self-monitoring type.
   a. Sensor Edge Bulb Color: Black.
6. Remote-Control Station: Interior.
7. Other Equipment: Radio-control system.

J. Door Finish:
1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.08 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.09 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.03 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08 33 33

COILING COUNTER DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Coiling counter doors.

B. Related Sections:
   1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
   2. Section 08 33 23 “Overhead Coiling Doors” for non-insulated and insulated service doors.

1.02 PERFORMANCE REQUIREMENTS

A. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Curtain Slats: 12 inches long.
   2. Bottom Bar: 6 inches long.
   3. Guides: 6 inches long.
   4. Brackets: 6 inches square.
   5. Hood: 6 inches square.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.
   1. Obtain operators and controls from coiling counter door manufacturer.

C. Regulatory Requirements: Comply with applicable provisions in ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.01 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch and as required to meet requirements.
   2. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.

B. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.02 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Stainless Steel: 0.025-inch- thick stainless-steel sheet, Type 304, complying with ASTM A 666.
   2. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.

2.03 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   1. Lock Cylinders: Provide cylinders specified in Section 087100 "Door Hardware" and keyed to building keying system.
   2. Keys: Provide three for each cylinder.

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.04 CURTAIN ACCESSORIES

A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
   1. Smoke Seals: Equip each smoke control door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.
   2. Provide pull-down straps or pole hooks for doors more than 84 inches high.

2.05 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.06 COUNTER DOOR ASSEMBLY

A. Coiling Counter Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; 651 Series Overhead Coiling Counter Doors or comparable product by one of the following:
      a. Cookson Company.
      b. Cornell Iron Works, Inc.

B. Operation Cycles: Not less than 20,000.
   1. Include tamperproof cycle counter.

C. STC Rating: 27.

D. Door Curtain Material: Stainless steel.

E. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

G. Hood: Match curtain material and finish.
   1. Shape: Round.
   2. Mounting: Face of wall.

H. Integral Frame, Hood, and Fascia for Counter Door: Stainless steel.
   1. Mounting: Face of wall.

I. Sill Configuration for Counter Door: As indicated.

J. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside and outside with cylinders.

K. Operation: Manual push up.

L. Door Finish:
1. Stainless-Steel Finish: No. 4 (polished directional satin).
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

2.09 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

3.03 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08 43 13

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Aluminum-framed storefront, with vision glass.

C. Perimeter sealant.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers: Perimeter sealant and back-up materials.

B. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2012.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Design Data: Provide framing member structural and physical characteristics, dimensional limitations.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum five years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulating glazing.
   2. Glazing Rabbet: For 1/4 inch monolithic glazing.
   3. Glazing Position: Centered (front to back).
   4. Finish: Class I natural anodized.
   5. Basis of Design: Subject to compliance with requirements, provide Kawneer North America; TRIFAB 450 for monolithic glazing, TRIFAB 451T for insulating glazing or comparable product by one of the following:
      a. Other Acceptable Manufacturers:
         1) YKK AP America Inc.
         2) United States Aluminum Corp.

2.02 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing stops: Flush.
   3. Cross-Section: As indicated on drawings.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Perimeter Sealant: Type 1 specified in Section 07 90 05.

D. Glass: As specified in Section 08 80 00.

E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.04 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating or AAMA 612 clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mils thick.

2.05 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce framing members for imposed loads.

G. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Set thresholds in bed of mastic and secure.

K. Install glass in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

L. Install perimeter sealant in accordance with Section 07 90 05.

M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.02 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

3.04 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.05 PROTECTION

A. Protect installed products from damage during subsequent construction.

END OF SECTION

SECTION 08 56 55

TICKET WINDOWS

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Section Includes:
   1. Fixed, transaction ticket windows.

1.02 COORDINATION

A. Coordinate installation of anchorages for ticket windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for window units.

B. Shop Drawings: For ticket windows.
   1. Include plans, elevations, sections, and attachments to other work.
   2. Full-size section details of framing members.
   3. Glazing details.
   4. Details of deal tray, transaction counter, and speaking aperture.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Framing: 12-inch- long sections of frame members.

1.05 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Pack ticket windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.

B. Label ticket window packaging with drawing designation.

C. Store crated ticket windows on raised blocks to prevent moisture damage.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace ticket windows that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 FIXED, TRANSACTION TICKET WINDOWS

A. Provide fixed, framed transaction windows with operable sash or ventilator capable of allowing transfer of currency and documents.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide aluminum ticket window, catalog number SCW102N, manufactured by C. R. Laurence, Co. Inc.; or comparable product by one of the following:
      a. Creative Industries, Inc.
      b. Quikserv Corp.

B. Configuration: One fixed-glazed panel.

C. Framing: Fabricate perimeter framing, mullions, and glazing stops from aluminum as follows:
   1. Profile: Manufacturer's standard, with minimum face dimension indicated.
      a. Minimum Face Dimension: 0.625 inches.
   2. Depth: Minimum Dimension: 1.390 inches.

D. Transaction Counter: 16 gauge, stainless steel, 18 inches deep by width of ticket window, centered in opening.

E. Glazing: 0.25” tempered glass.

F. Materials:
   1. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666 or ASTM A 240/A 240M, austenitic stainless steel, Type 304.
   2. Aluminum Extrusions: ASTM B 221. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength.
   3. Aluminum Sheet and Plate: ASTM B 209.

2.02 FABRICATION

A. General: Fabricate ticket windows to provide a complete system for assembly of components and anchorage of window units.
   1. Prepare ticket windows for glazing unless preglazing at the factory is indicated.

B. Framing: Pprovide snap-in cover for fastening channel..

C. Glazing Stops: Stops integral with frame extrusion.

D. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

E. Factory-cut openings in glazing for speaking apertures.

2.03 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.04 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.05 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain of directional finishes with long dimension of each piece.
   2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   3. Directional Satin Finish: No. 4.

2.06 ACCESSORIES

A. Transaction Door: Half-round pivoting door, formed from stainless steel with exposed flanges for installation into sill framing.

B. Speaking Apertures: No-draft stainless steel speaking louver.
   1. Shape: Circular.
   2. Product: Model 834A manufactured by C. R. Laurence, Co. Inc

C. Compression-Type Glazing Strips and Weather Stripping: Unless otherwise indicated, provide compressible stripping for glazing and weather stripping, such as molded EPDM or neoprene gaskets complying with ASTM D 2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D 2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

D. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers and with a proven record of compatibility with surfaces contacted in installation.
   1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
   2. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
   3. Spacers: Elastomeric blocks or continuous extrusions with a Type A Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B 633.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Sealants: For sealants required within fabricated ticket windows, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of ticket windows.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of ticket window connections before ticket window installation.

C. Inspect built-in and cast-in anchor installations, before installing ticket windows, to verify that anchor installations comply with requirements. Prepare inspection reports.
   1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
   2. Perform additional inspections to determine compliance of replaced or additional work. Prepare anchor inspection reports.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing ticket windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.

B. Fasteners: Install ticket windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials.

C. Sealants: Comply with requirements in Section 07 90 05 "Joint Sealers" for installing sealants, fillers, and gaskets.
   1. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
   2. Seal frame perimeter with sealant to provide weathertight construction unless otherwise indicated.

D. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.03 ADJUSTING

A. Remove and replace defective work, including ticket windows that are warped, bowed, or otherwise unacceptable.

3.04 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation of ticket windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.

B. Clean glass of preglazed ticket windows promptly after installation.

C. Provide temporary protection to ensure that ticket windows are without damage at time of Substantial Completion.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Section 06 10 00 - Rough Carpentry.
   2. Section 08 06 10 - Door Schedule.
   3. Section 08 06 71 - Door Hardware Schedule.
   4. Section 08 11 13 - Hollow Metal Doors and Frames.
   5. Section 28 13 00 - Access Control.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
   3. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtin Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
   4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure difference.
   5. ASTM E1996 - Standard specification for performance of exterior windows, curtain walls, doors and storm shutters impacted by Windborne Debris in Hurricanes.
   6. FEMA 361 2008 - Design and Construction Guidance for Community Safe Rooms.
   7. ICC 500 - ICC/NSSA Standard for the Design and Construction of Storm Shelters.
   8. ICC/IBC - International Building Code.
   9. NFPA 70 - National Electrical Code.
   10. NFPA 80 - Fire Doors and Windows.
   11. NFPA 101 - Life Safety Code.
   12. NFPA 105 - Installation of Smoke Door Assemblies.
   13. TAS-201-94 - Impact Test Procedures.
   14. TAS-202-94 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components using Uniform Static Air Pressure.
   15. TAS-203-94 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

E. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C - Positive Pressure Fire Tests of Door Assemblies

1.02 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
   3. Content: Include the following information:
      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.
      g. Door and frame sizes and materials.
   4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.

D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

E. Informational Submittals:
   1. LEED Submittals: Manufacturer's product information and applicable sustainability program credits that are available to contribute towards a LEED rated project certification.
      a. Credit MR 4.1 and 4.2: Manufacturer's or fabricator's certificate indicating percentage of post-consumer recycled content by weight and pre-consumer recycled content by weight for each Product specified under this Section. Use materials with recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (total of 20% based on cost) of the total values of the material in the project as follows:

1) Floor Closers: 63%
2) Pivots: 78%
3) Cylindrical Locks: 58%
4) Mortise Locks: 57%
5) Exit Devices: 54%
6) Door Closers: 51%
7) Overhead Stops: 46%

b. Low-Emitting Materials EQ 4.2: Provide products that reduce the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants; products shall not produce VOC emissions.

2. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

G. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.03 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers and Installers are to be factory trained, certified, and a direct purchasers of the specified products and be responsible for commissioning and servicing the installed equipment indicated for the Project.

E. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through current members of the manufacturer's "Power Operator Preferred Installer" program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.

F. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
   1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
   2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

G. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
   1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
         2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
      c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
   3. NFPA 101: Comply with the following for means of egress doors:
      a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
      b. Thresholds: Not more than 1/2 inch high.
   4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
      a. Test Pressure: Positive pressure labeling.

H. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, arrange for manufacturers' representatives to hold a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
   2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
   3. Review sequence of operation narratives for each unique access controlled opening.
   4. Review and finalize construction schedule and verify availability of materials.
   5. Review the required inspecting, testing, commissioning, and demonstration procedures.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.05 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.06 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of the hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
   1. Ten years for mortise locks and latches.
   2. Ten years for extra heavy duty cylindrical (bored) locks and latches.
   3. Seven years for heavy duty cylindrical (bored) locks and latches.
   4. Five years for standard duty cylindrical (bored) locks and latches.
   5. Five years for exit hardware.
   6. Ten years for manual door closers.
   7. Two years for electromechanical door hardware.

1.07 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
   1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
      a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
   2. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
      a. Permanent cylinders, cores, and keys to be installed by Owner.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.02 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
      a. Two Hinges: For doors with heights up to 60 inches.
      b. Three Hinges: For doors with heights 61 to 90 inches.
      c. Four Hinges: For doors with heights 91 to 120 inches.
      d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
   2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
      a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
      b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
   3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
      a. Exterior Doors: Heavy weight, non-ferrous, ball bearing hinges unless Hardware Sets indicate standard weight.
      b. Interior Doors: Standard weight, steel, ball bearing hinges unless Hardware Sets indicate heavy weight.
      c. Tornado Resistant Assemblies: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a Severe Storm Shelter Opening meeting ICC 500 and FEMA 361.
   4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
      a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
         1) Out-swinging exterior doors.
         2) Out-swinging access controlled doors.
   5. Acceptable Manufacturers:
      a. Hager Companies (HA).
      b. McKinney Products (MK).
      c. Stanley Hardware (ST).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.
   1. Acceptable Manufacturers:
      a. McKinney Products (MK).
      b. Pemko Manufacturing (PE).
      c. Stanley Hardware (ST).

2.03 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
   1. Acceptable Manufacturers:
      a. Hager Companies (HA) - ETW-QC (# wires) Option.
      b. McKinney Products (MK) - QC (# wires) Option.

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a 12" removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
   1. Acceptable Manufacturers:
      a. McKinney Products (MK) - SER-QC (# wires) Option.
      b. Pemko Manufacturing (PE) - SER-QC (# wires) Option.

C. Provide mortar guard enclosure on steel frames installed at masonry openings for each electrical hinge specified.

D. Electric Door Hardware Cords: Provide electric transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
   1. Acceptable Manufacturers:
      a. McKinney Products (MK) - Inner Door Cord 3 inches: QC-C003P.
      b. McKinney Products (MK) - Inner Door Cord 3 foot door: QC-C206P.
      c. McKinney Products (MK) - Inner Door Cord 4 foot door: QC-C306P.
      d. McKinney Products (MK) - Inner Door Cord 15 feet: QC-C1500P.
      e. McKinney Products (MK) - Hinge to Junction Panel 15 feet: QC-C1500P.
   2. Provide one each of the following tools as part of the base bid contract:
      a. McKinney Products (MK) - Electrical Connecting Kit: 52-3000.
      b. McKinney Products (MK) - Connector Hand Tool: 52-0439.

2.04 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
   1. Acceptable Manufacturers:
      a. Door Controls International (DC).
      b. McKinney Architectural Hardware (MK).

c. Rockwood Manufacturing (RO).
d. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Coordinators fabricated from steel with nylon-coated strike plates and built-in adjustable safety release.
1. Acceptable Manufacturers:
a. Door Controls International (DC).
b. McKinney Architectural Hardware (MK).
c. Rockwood Manufacturing (RO).
d. Trimco (TC).

C. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, 4-inches wide by 16-inches high, with square corners and beveled edges, secured with exposed screws unless otherwise indicated.
2. Straight Pull Design: Minimum 1-inch round diameter stainless steel bar or tube stock pulls with 2 1/2-inch projection from face of door unless otherwise indicated.
3. Offset Pull Design: Minimum 1-inch round diameter stainless steel bar or tube stock pulls with 2 1/2-inch projection and offset of 90 degrees unless otherwise indicated.
4. Push Bars: Minimum 1-inch round diameter horizontal push bars with minimum clearance of 2 1/2-inch projection from face of door unless otherwise indicated.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
a. Acceptable Manufacturers:
1) McKinney Architectural Hardware (MK).
2) Rockwood Manufacturing (RO).
3) Trimco (TC).

2.05 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
1. Acceptable Manufacturers:
a. Stanley Best (BE).

C. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.

E. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:
   1. Master Key System: Cylinders are operated by a change key and a master key.
   2. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
   3. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
   4. Existing System: Master key or grand master key locks to Owner's existing system.
   5. Keyed Alike: Key all cylinders to same change key.

F. Key Quantity: Provide the following minimum number of keys:
   1. Top Master Key: One (1)
   2. Change Keys per Cylinder: Two (2)
   3. Master Keys (per Master Key Group): Two (2)
   4. Grand Master Keys (per Grand Master Key Group): Two (2)
   5. Construction Control Keys (where required): Two (2)
   6. Permanent Control Keys (where required): Two (2)

G. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

H. Key Registration List: Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall expansion capacity of 150% of the number of locks required for the project.
   1. Acceptable Manufacturers:
      a. Lund Equipment (LU).
      b. Telkee (TK).

J. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into “Key Wizard” software.

2.06 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.
   1. Acceptable Manufacturers:
      a. Corbin Russwin Hardware (RU) - ML2000 Series.
      b. Sargent Manufacturing (SA) - (R)8200 Series.
      c. Schlage (SC) - L9000 Series.
      d. Stanley Best (BE) - 47H Series.

B. Lock Trim Design: As specified in Hardware Sets.

C. Knurling: Where specified provide knurling or abrasive coating to all levers on doors leading to hazardous areas such as mechanical rooms, boiler and furnace rooms, janitor closets, and as otherwise required by the Illinois Accessibility Code.

2.07 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
   1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.
   2. Acceptable Manufacturers:
      a. Corbin Russwin Hardware (RU) - ML20900 Series.
      b. Sargent Manufacturing (SA) - 8200 Series.
      c. Schlage (SC) - L9000 EL/EU/RX Series.
      d. Stanley Best (BE) - 47HW EL/EU Series.

2.08 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.5, Grade 1, certified small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.
   1. Acceptable Manufacturers:
      a. Corbin Russwin Hardware (RU) - DL4100 Series.
      b. Sargent Manufacturing (SA) - 4870 Series.
      c. Schlage (SC) - L460 Series.
      d. Stanley Best (BE) - 48H Series.

2.09 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
   a. Fire Exit Removable Mullions: Provide keyed removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions to be used only with exit devices for which they have been tested.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.
   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. Provided free-wheeling type trim where indicated.
   b. Where function of exit device requires a cylinder, provide an interchangeable core type keyed cylinder (Rim or Mortise) as specified in Hardware Sets.
6. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.
7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.
   1. Acceptable Manufacturers:
      a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
      b. Sargent Manufacturing (SA) - 80 Series.
      c. Von Duprin (VD) - 35A/98/99 XP Series.
      d. Yale Locks and Hardware (YA) - 7000 Series.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish. Provide keyed removable feature, stabilizers, and mounting brackets as specified in the Hardware Sets. At openings designed for severe wind load conditions due to hurricanes or tornadoes, provide manufacturers approved mullion and accessories to meet applicable state and local windstorm codes.
   1. Acceptable Manufacturers:
      a. Corbin Russwin Hardware (RU) - 700/900 Series.
      b. Sargent Manufacturing (SA) - 980S Series.
      c. Von Duprin (VD) - 9954 Series.
      d. Yale Locks and Hardware (YA) - M200 Series.

2.11 ELECTROMECHANICAL CONVENTIONAL EXIT DEVICES

A. Electrified Conventional Push Rail Devices (Heavy Duty): Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified below.
   1. Acceptable Manufacturers:
      a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
      b. Sargent Manufacturing (SA) - 80 Series.
      c. Von Duprin (VD) - 35A/98/99 Series.
      d. Yale Locks and Hardware (YA) - 7000 Series.

B. Electrified Options: As indicated in hardware sets, provide electrified exit device options including: electric latch retraction, electric dogging, outside door trim control, exit alarm, delayed egress, latchbolt monitoring, lock/unlock status monitoring, touchbar monitoring and request-to-exit signaling. Unless otherwise indicated, provide electrified exit devices standard as fail secure.

C. Hurricane and Tornado Resistance Compliance: Electromechanical conventional exit devices and electrified tube steel removable mullions to be U.L. listed for windstorm components where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

2.12 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
   1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
   2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire

Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1 provisions for door opening force and delayed action closing.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
   a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
   b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
   c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
5. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units and high impact, non-corrosive plastic covers standard.
   1. Acceptable Manufacturers:
      a. Corbin Russwin Hardware (RU) - DC8000 Series.
      b. Sargent Manufacturing (SA) - 351 Series.
      c. Norton Door Controls (NO) - 7500 Series.
      d. Yale Locks and Hardware (YA) - 4400 Series.

2.13 AUTOMATIC DOOR OPERATORS

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
   1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Electromechanical Door Operators: Self-contained units powered by permanent magnet DC motor, with closing speed controlled mechanically by gear train, connections for power, activation and safety device wiring, and manual operation including spring closing when power is off.

C. Electrohydraulic Door Operators: Self-contained low-pressure units with separate cylinders for power and checking, connections for power, activation, and safety device wiring and manual operation including spring closing when power is off.

D. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

E. Standard: Certified ANSI/BHMA A156.19.

1. Performance Requirements:
   a. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
   b. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

F. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.

G. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.
   1. On-off switch to control power to be key switch operated.

H. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

I. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

J. Activation Devices: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.

K. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.
   1. Acceptable Manufacturers:
      a. Besam Automated Entrance Systems (BE) - SW100 Series.
      b. LCN Closers (LC) - 4640 Series.
      c. Norton Door Controls (NO) - 6900 PowerMatic Series.
      d. Sargent Manufacturing (SA) - MPower CL4000 Series.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim
   1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
   2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
   3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.
      a. Stainless Steel: 050-inch thick, with countersunk screw holes (CSK).
      b. Brass or Bronze: 050-inch thick, with countersunk screw holes (CSK).
      c. Laminate Plastic or Acrylic: 1/8-inch thick, with countersunk screw holes (CSK).
   4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.

5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.
6. Acceptable Manufacturers:
   a. McKinney Architectural Hardware (MK).
   b. Rockwood Manufacturing (RO).
   c. Trimco (TC).

2.15 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
   1. Acceptable Manufacturers:
      a. McKinney Architectural Hardware (MK).
      b. Rockwood Manufacturing (RO).
      c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
   1. Acceptable Manufacturers:
      a. Rixson Door Controls (RF).
      b. Rockwood Manufacturing (RO).
      c. Sargent Manufacturing (SA).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: :Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Acceptable Manufacturers:
   1. McKinney Weatherstripping Products (MW).
   2. Pemko Manufacturing (PE).
   3. Reese Enterprises, Inc. (RS).

2.17 ELECTRONIC ACCESSORIES

A. Key Switches: Key switches furnished standard with stainless steel single gang face plate with a 12/24VDC bi-color LED indicator. Integral backing bracket permits integration with any 1 1/4" or 1 1/2" mortise type cylinder. Key switches available as momentary or maintained action and in narrow face plate options.
   1. Acceptable Manufacturers:
      a. Security Door Controls (SD) - 800 Series.
      b. Securitron Door Controls (SU) - MK Series.

B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
   1. Acceptable Manufacturers:
      a. Security Door Controls (SD) - 630 Series.
      b. Securitron Door Controls (SU) - BPS 12/24 Series.

2.18 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Antimicrobial Finishes: Where specified, finishes on locksets, latchsets, exit devices and push/pull trim to incorporate an FDA recognized. Silver Ion, antimicrobial coating (MicroShield™) listed for use on equipment as a suppressant to the growth and spread of a broad range of bacteria, algae, fungus, mold and mildew.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.

D. Power Operator products and accessories are required to be installed through current members of the manufacturer's "Power Operator Preferred Installer" program.

E. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

G. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.06 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.08 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Refer to Section 080671, Door Hardware Schedule, for hardware sets.

END OF SECTION 087100

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Glass.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers.

B. Section 07 90 05 - Joint Sealers: Sealant and back-up material.

C. Section 08 43 13 - Aluminum-Framed Storefronts.

1.03 REFERENCE STANDARDS

A. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

B. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

C. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2012.

D. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 2008.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Samples: Submit two samples 12 x 12 inch in size of glass units.

D. Samples: Submit 3 inch long bead of glazing sealant, color as selected.

E. Manufacturer's Certificate: Certify that Type 1 and Type 2 glass meets or exceeds specified requirements.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with FGMA Sealant Manual for glazing installation methods.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLAZING TYPES

A. Type 1 - Sealed Insulating Glass Units: Vision glazing, low-E.
   1. Application: Exterior glazing where indicated.
   2. Substitutions: Refer to Section 01 60 00 - Product Requirements.
      a. Other products of the basis of design manufacturer and products of other manufacturers will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
      b. Architect's decision on substitutions is final.
   3. Between-lite space filled with air.
   4. Thermal Resistance (U-Value): 0.29 winter/0.28 summer, nominal.
   5. Total Solar Heat Gain Coefficient: 0.30, nominal.
   6. Total Visible Light Transmittance: 49 percent, minimum.
   7. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint and Coating: Guardian CrystalGray with SunGuard SN 68 on #2 surface.
   8. Inboard Lite: Annealed float glass, 1/4 inch thick.
      a. Tint: None (clear).
   9. Basis of Design: Guardian Industries Corp: www.sunguardglass.com. Subject to compliance with requirements, provide comparable products by one of the following:
      a. PPG Industries, Inc.
      b. AGC Flat Glass North America, Inc.
      c. Pilkington North America Inc.

B. Type 2 - Sealed Insulating Glass Units: Safety glazing:
   1. Applications: Provide this type of glazing in the following locations:
      a. Glazed sidelights and panels next to doors.
      b. Other locations required by applicable federal, state, and local codes and regulations.
      c. Other locations indicated on the drawings.
   2. Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.

C. Type 3 - Single Vision Glazing:
   1. Applications: All interior glazing unless otherwise indicated.
   2. Type: Annealed float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch.
   5. Glazing Method: Gasket glazing.

D. Type 4 - Single Vision Glazing:
   1. Applications: As shown and scheduled.
   2. Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch.
   5. Glazing Method: Gasket glazing.

2.02 EXTERIOR GLAZING ASSEMBLIES

A. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.
   2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.03 GLASS MATERIALS

A. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Fully Tempered Types: ASTM C1048.
   3. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

2.04 SEALED INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.
   2. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Sealed Insulating Glass Units: Types as indicated.
   1. Locations: Exterior, except as otherwise indicated.
   2. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   3. Edge Spacers: Aluminum, mitered and spigoted corners.
   4. Edge Seal: Glass to elastomer.
   5. Purge interpane space with dry hermetic air.

2.05 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
   1. Manufacturers:
      a. Pecora Corporation: www.pecora.com.
      b. Tremco Global Sealants: www.tremcosealants.com.
      c. Substitutions: Refer to Section 01 60 00 - Product Requirements.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; black color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.03 MANUFACTURER'S FIELD SERVICES

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.04 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

END OF SECTION

SECTION 08 91 00

LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers.

B. Section 23 31 00 - HVAC Ducts and Casings: Ductwork attachment to louvers.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2010.

B. AMCA 511 - Certified Ratings Program for Air Control Devices; Air Movement and Control Association International, Inc.; 2010.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of exterior surfaces.

E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall Louvers:
   1. Airolite Company, LLC: www.airolite.com.
   2. American Warming and Ventilating: www.awv.com.

3. Construction Specialties, Inc: www.c-sgroup.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified under AMCA 511.
   1. Wind Load Resistance: Design to resist positive and negative wind load as required by code without damage or permanent deformation.
   2. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
   3. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers at exterior walls: Horizontal blade, extruded aluminum construction, with intermediate mullions matching frame.
   1. Free Area: 50 percent, minimum.
   2. Blades: Stormproof.
   3. Frame: 4 inches deep, channel profile; corner joints mitered and mechanically fastened, with continuous recessed caulking channel each side.
   4. Metal Thickness: Frame 0.081 inch; blades 0.081 inch.
   5. Finish: Clear anodized; finish welded units after fabrication.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M),.

B. Bird Screen: Interwoven wire mesh of steel, 0.063 inch diameter wire, 1/2 inch open weave, square design.

C. Insect Screen: 18 x 16 size aluminum mesh.

D. Polyvinylidene Fluoride Coating: Minimum 70 percent Kynar 500/Hylar 500 resin, three coat finish, complying with AAMA 2604.

2.04 ACCESSORIES

A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 1 inch thick, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Fasteners and Anchors: Stainless steel.

D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

E. Sealant: Type 1, as specified in Section 07 90 05.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

E. Install perimeter sealant and backing rod in accordance with Section 07 90 05.

F. Coordinate with installation of mechanical ductwork.

3.02 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION

SECTION 09 05 61

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. This section applies to all floors identified in the contract documents as to receive the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Fluid-Applied Flooring.

C. Preparation of new concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and pH.

E. Remediation of concrete floor slabs due to unsatisfactory moisture or pH conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

1.02 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and pH limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Testing Agency's Report: Include:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and pH test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Submit report directly to Owner.
   7. Submit report not more than two business days after conclusion of testing.

C. Adhesive Bond and Compatibility Test Report.

1.03 QUALITY ASSURANCE

A. Moisture and pH testing will be performed by an independent testing agency employed and paid by Owner.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.

3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Owner when specified ambient conditions have been achieved and when testing will start.

1.04 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of pH found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: 1/8 inch, maximum.
   2. If testing agency recommends any particular products, use one of those.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
   3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   4. pH tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   5. Specified remediation, if required.
   6. Patching, smoothing, and leveling, as required.
   7. Other preparation specified.

8. Adhesive bond and compatibility test.
9. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating over entire suspect floor area.
3. Excessive pH: If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.05 pH TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Note: This procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

C. Use a wide range pH paper, its associated chart, and distilled or deionized water.

D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the pH paper into the water, remove it, and compare immediately to chart to determine pH reading.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value is over 10.

3.06 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.09 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - BPD - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2011a.

C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.

D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2011.

E. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

G. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2010a.

H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2011.

I. ASTM C1629/C1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2006.

J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

K. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2010.

L. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2010.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: For all stud framing products that do not comply with ASTM C645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

E. LEED Submittals:
   1. For gypsum wallboard, submit documentation of recycled content and location of manufacture.
   2. For steel products, submit documentation of steel mill process, location of mill, and location of manufacture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Marino\Ware: www.marinoware.com.
   3. Phillips Manufacturing Company: www.phillipsmfg.com.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/360 at 7.5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
   2. Studs: "C" shaped with flat or formed webs 20 gage minimum.
   3. Runners: U shaped, sized to match studs.
   4. Ceiling Channels: C shaped.
   5. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging both sides.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com.
   3. Lafarge North America Inc: www.lafargenorthamerica.com.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. USG Corporation: www.usg.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold-resistant board is required at all locations.
   3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C 1629.
   1. Application: Up to 8 feet above finish floor in areas scheduled to receive gypsum board.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
   4. Type: Fire-resistance rated Type X, UL or WH listed.
   5. Thickness: 5/8 inch
   6. Edges: Tapered.
   7. Products:
      a. National Gypsum Company; Gold Bond Hi-Impact Brand XP Wallboard.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Type X, in locations indicated.
   4. Type X Thickness: 5/8 inch.
   5. Edges: Tapered.

E. Ceiling Board: Special sag-resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 5/8 inch.
   3. Edges: Tapered.

2.04 ACCESSORIES

A. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, or rigid plastic, unless otherwise indicated.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional cornerbead and control joints, provide L-bead at exposed panel edges.

B. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and cornersin wet areas.
   2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Powder-type vinyl-based joint compound.

C. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

D. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

E. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs as indicated.
   1. Extend partition framing to structure in typical conditions, 6 inches above ceiling at perimeter wall conditions and as indicated.
   2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

3.03 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
3. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
4. Level 0: Temporary partitions and surfaces indicated to be finished in later stage of project.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Suspended metal grid ceiling system.

C. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2007.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2008.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2011.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2008e1.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. LEED Submittal: Documentation of recycled content and location of manufacture.

1.05 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. Basis of Design: Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG: www.usg.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Acoustical Units - General: ASTM E1264, Class A.

C. Acoustical Panels Type ACP-1: Ceramic and mineral fiber composite with the following characteristics:
   1. Size: 24 x 24 inches.
   2. Thickness: 5/8 inches.
   3. Composition: Ceramic and mineral fiber composite.
   4. NRC Range: 0.55 as specified in ASTM E1264.
   5. Ceiling Attenuation Class (CAC): 38, determined as specified in ASTM E1264.
   6. Edge: Square.
   7. Surface Color: White.
   8. Product: Ceramaguard Fine Fissured Perforated, Model # 607 by Armstrong.
   9. Suspension System: Exposed grid Type 1.

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. USG: www.usg.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems - General: ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Exposed Steel Suspension System Type 1: Formed G90 hot-dipped galvanized steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.
   3. Finish: White painted.
   4. Product: Prelude Plus XL by Armstrong.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.02 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 66

RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Rubber tile flooring, adhesively installed.

C. Resilient base.

D. Water-jet cut logo inlay.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, and layout, colors, logos and equipment locations.

D. LEED Submittal: Documentation of recycled content and location of manufacture.

E. Selection Samples: Manufacturer's color charts for flooring materials specified, indicating full range of colors and textures available.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.06 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70-95 degrees F for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F or to go above 100 degrees F.

PART 2 PRODUCTS

2.01 PREFORMED ATHLETIC FLOORING

A. Manufacturers:
   1. Nora; Norament 992 Granno.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Rubber Tile Flooring: Virgin rubber material formed into square tiles <>, laid with adhesive.
   1. Thickness: Minimum 3/8 in.
   2. Size: Nominal 36 in square.
   3. Surface Texture: Lightly textured.
   4. Color: As selected from manufacturer's standards.

2.02 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

B. Adhesive: Water-resistant type recommended by flooring manufacturer for project conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius.

B. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.

C. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Comply with manufacturer's recommendations and approved shop drawings.

C. Rubber Tile Flooring:

1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.
3. Install water-cut logo floor tile pieces as shown on Drawings.

3.04 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

A. Protect finished athletic flooring from construction traffic to insure that it is without damage upon completion of the work.

END OF SECTION

SECTION 09 67 00

FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Fluid-applied flooring and base.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples: Submit two samples, 6 x 6 inch in size illustrating color and texture for each floor material for each color specified.
   1. Provide three different textures for each color.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

F. LEED Submittal: Documentation of recycled content and location of manufacture.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 5 years documented experience.

B. Applicator Qualifications: Company specializing in performing work of this section with minimum 5 years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.06 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Trowel applied multi-component epoxy urethane flooring systems.

B. Fluid-Applied Flooring Type PE-1: Urethane, single component, thermosetting, with flake broadcast on base coat..
   1. Product: Basis of Design: StonTec TRF manufactured by Stonhard.
   2. Thickness: Nom. 1/8 to 3/16 inch.
   3. Broadcast flakes with urethane sealer.

2.02 ACCESSORIES

A. Cant Strips: Molded material compatible with flooring.

B. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

C. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

C. Verify that concrete sub-floor surfaces are ready for flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by flooring materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

D. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness indicated.

C. Finish to smooth level surface.

D. Cove at vertical surfaces.

3.04 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until cured.

3.05 SCHEDULE

A. All locations:
   1. Type PE-1: Light texture #2.
   2. Color: Custom Blend: Vi-Tech-92C

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 74 19 - Construction Waste Management and Disposal: Reclamation/Recycling of new carpet tile scrap.

C. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2010e1.

B. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

C. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. LEED Report: Submit data documenting VOC content of carpet tile and adhesives; copy of current CRI Approved Products Listing is acceptable.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years experience.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Carpet Tile Type WOC-1: Tip-sheared loop, manufactured in one color dye lot.
   1. Product: Ruffian II manufactured by Mannington.
   2. Tile Size: 24 x 24 inch, nominal.
   3. Color: See Finish Schedule.

2.02 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum, Architect to select color.

C. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI Carpet Installation Standard.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern or as scheduled and shown, with pile direction alternating to next unit, set parallel to building lines.

F. Fully adhere carpet tile to substrate.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Surfaces to be finished are indicated in this section and on the Drawings.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 50 00 - Metal Fabrications: Shop-primed items.

C. Section 05 51 00 - Metal Stairs: Shop-primed items.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Master Painters and Decorators Association; 2004.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system (copy of relevant MPI Manual page is acceptable).

C. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

D. Samples: Submit one paper "drop" samples, 8-1/2 by 11 inches in size, illustrating colors selected for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

B. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide wall panel, 8 feet long by 10 feet wide, illustrating coating color, texture, and finish.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Supply 1 gallon of each color; store where directed.

C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

C. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

D. Paints: Acceptable manufacturers are limited to the following:
   1. Benjamin Moore & Co: www.benjaminmoore.com.
   2. Sherwin-Williams: www.sherwin-williams.com.
   3. Glidden Professional: www.gliddenprofessional.com.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Nonflat: 150 g/L, maximum.
         3) Opaque, High Gloss: 250 g/L, maximum.
         4) Varnishes: 350 g/L, maximum.
      c. Architectural coatings VOC limits of State in which the project is located.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Paints and Coatings: Provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI Categories, except as otherwise indicated.
   1. Provide ready mixed paints and coatings.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 PAINT SYSTEMS

A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.

B. Provide colors as directed by Architect.
   1. Allow for minimum of five colors for each system, unless otherwise indicated, without additional cost to Owner.
   2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.04 EXTERIOR PAINT SYSTEMS

A. SYSTEM E-1:
   1. Substrate: Structural Steel and Metal Fabrications:
   2. Applications include but are not limited to structural steel.
   3. Manufacturers and products:
      a. Sherwin Williams:
         1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
         2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8 Series
         3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8 Series
      b. Benjamin Moore:
         1) 1st Coat: Moore PO6 Super Spec HP Alkyd Metal Primer
         2) 2nd Coat: 096 MoorGlo Acrylic Semi-Gloss House Paint
         3) 3rd Coat: 096 MoorGlo Acrylic Semi-Gloss House Paint
      c. Glidden Professional:
         1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
         2) 2nd Coat: Glidden Professional Fortis 450 6407 topcoat
         3) 3rd Coat: Glidden Professional Fortis 450 6407 topcoat

B. SYSTEM E-2:
   1. Substrate: Hollow metal door frames:
   2. Finish: Gloss.
   3. Manufacturers and Products:
      a. Sherwin Williams:
         1) 1st Coat: DTM Acrylic Primer/Finish, B66W1
         2) 2nd Coat: DTM Acrylic Gloss Coating, B66W100
         3) 3rd Coat: DTM Acrylic Gloss Coating, B66W100
      b. Benjamin Moore:
         1) 1st Coat: Moorcraft Super Spec DTM Alkyd Satin, Z163
         2) 2nd Coat: Moorcraft Super Spec Urethane Gloss Enamel, Z22
         3) 3rd Coat: Moorcraft Super Spec Urethane Gloss Enamel, Z22
      c. Glidden Professional:
         1) 1st Coat: DEVGUARD 4360 Low VOC Universal Primer
         2) 2nd Coat: DEVGUARD 4309 Rust Preventative Gloss Enamel
         3) 3rd Coat: DEVGUARD 4309 Rust Preventative Gloss Enamel

C. SYSTEM E-3:
   1. Substrate: Galvanized Metal, Not Chromate Passivated:
   2. Applications include but are not limited to railings, lintels and bollards.
   3. Manufacturers and Products:
      a. Sherwin Williams:
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
         2) 2nd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
         3) 3rd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
      b. Benjamin Moore:
         1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
         2) 2nd Coat: Moore N096 MoorGlo Acrylic Semi-Gloss House Paint
         3) 3rd Coat: Moore N096 MoorGlo Acrylic Semi-Gloss House Paint
      c. Glidden Professional:
         1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
         2) 2nd Coat: Glidden Professional Fortis 450 6407 topcoat
         3) 3rd Coat: Glidden Professional Fortis 450 6407 topcoat

2.05 INTERIOR PAINT SYSTEMS

A. SYSTEM I-1:
   1. Substrate: Concrete Masonry Units
   2. Manufacturers and Products:
      a. Sherwin Williams:
         1) 1st Coat: S-W PrepRite® Block Filler, B25W25
         2) 2nd Coat: S-W ProMar® 200 Latex Semi-Gloss, B20W2200 Series
         3) 3rd Coat: S-W ProMar® 200 Latex Semi-Gloss, B20W2200 Series
      b. Benjamin Moore:
         1) 1st Coat: Moore 160 Super Spec Latex Block Filler
         2) 2nd Coat: 333 Regal AquaGlo Acrylic Semi-Gloss Enamel
         3) 3rd Coat: 333 Regal AquaGlo Acrylic Semi-Gloss Enamel
      c. Glidden Professional:
         1) 1st Coat: Glidden Professional Block Filler 3010 primer
         2) 2nd Coat: Glidden Professional Diamond 450 7400 topcoat
         3) 3rd Coat: Glidden Professional Diamond 450 7400 topcoat

B. SYSTEM I-2
   1. Substrate: Concrete Masonry Units (Epoxy paint, Semi-gloss finish)

2. Manufacturers and Products:
   a. Sherwin Williams:
      1) 1st Coat: S-W Heavy Duty Block Filler, B42W46
      2) 2nd Coat: S-W Pro Industrial HB/ Waterbased Epoxy, B71W111/B71W100 Series
      3) 3rd Coat: S-W Pro Industrial HB/ Waterbased Epoxy, B71W111/B71W100 Series
   b. Benjamin Moore:
      1) 1st Coat: Super Spec HP Waterborne Epoxy Block Filler P31
      2) 2nd Coat: Super Spec HP Acrylic Epoxy Coating P43
      3) 3rd Coat: Super Spec HP Acrylic Epoxy Coating P43
   c. Glidden Professional:
      1) 1st Coat: Tru-Glaze 4015 Block Filler
      2) 2nd Coat: Tru-Glaze WB 4426 Water-Based Epoxy
      3) 3rd Coat: Tru-Glaze WB 4426 Water-Based Epoxy

C. SYSTEM I-3
   1. Substrate: Structural Steel and Metal Fabrications:
   2. FInish: Semi-Gloss.
   3. Manufacturers and Products:
      a. Sherwin Williams:
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
         2) 2nd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
         3) 3rd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
      b. Benjamin Moore:
         1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
         2) 2nd Coat: N333 Regal AquaGlo Acrylic Semi-Gloss Enamel
         3) 3rd Coat: N333 Regal AquaGlo Acrylic Semi-Gloss Enamel
      c. Glidden Professional:
         1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
         2) 2nd Coat: Glidden Professional Diamond 450 7400 topcoat
         3) 3rd Coat: Glidden Professional Diamond 450 7400 topcoat

D. SYSTEM I-4
   1. Substrate: Hollow metal door frames:
   2. Finish: Gloss.
   3. Manufacturers and Products:
      a. Sherwin Williams:
         1) 1st Coat: DTM Acrylic Primer/Finish, B66W1
         2) 2nd Coat: DTM Acrylic Gloss Coating, B66W100
         3) 3rd Coat: DTM Acrylic Gloss Coating, B66W100
      b. Benjamin Moore:
         1) 1st Coat: Moorcraft Super Spec DTM Alkyd Satin, Z163
         2) 2nd Coat: Moorcraft Super Spec Urethane Gloss Enamel, Z22
         3) 3rd Coat: Moorcraft Super Spec Urethane Gloss Enamel, Z22
      c. Glidden Professional:
         1) 1st Coat: DEVGUARD 4360 Low VOC Universal Primer
         2) 2nd Coat: DEVGUARD 4309 Rust Preventative Gloss Enamel
         3) 3rd Coat: DEVGUARD 4309 Rust Preventative Gloss Enamel

E. SYSTEM I-5
   1. Substrate: Galvanized Metal, Not Chromate Passivated:
   2. Applications include but are not limited to railings and exposed ductwork.
   3. Manufacturers and Products:

a. Sherwin WIlliams:
   1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
   2) 2nd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
   3) 3rd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
b. Benjamin Moore:
   1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
   2) 2nd Coat: N333 Regal AquaGlo Acrylic Semi-Gloss Enamel
   3) 3rd Coat: N333 Regal AquaGlo Acrylic Semi-Gloss Enamel
c. Glidden Professional:
   1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
   2) 2nd Coat: Glidden Professional Diamond 450 7400 topcoat
   3) 3rd Coat: Glidden Professional Diamond 450 7400 topcoat

F. SYSTEM I-6
1. Substrate: Gypsum Board (Satin Finish):
2. Applications include but are not limited to walls, ceilings, soffits, bulkheads, and column covers.
3. Manufacturers and Products:
   a. Sherwin Williams:
      1) 1st Coat: S-W PrepRite 200 Int. Latex Primer, B28 Series
      2) 2nd Coat: S-W ProMar® 200 Latex Eggshell, B20Series
      3) 3rd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31Series
   b. Benjamin Moore:
      1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
      2) 2nd Coat: N319 Regal Acrylic Latex Eggshell Finish Enamel
      3) 3rd Coat: N319 Regal Acrylic Latex Eggshell Finish Enamel
   c. Glidden Professional:
      1) 1st Coat: Glidden Professional High Hide 1000 primer
      2) 2nd Coat: Glidden Professional Diamond 450 7300 topcoat
      3) 3rd Coat: Glidden Professional Diamond 450 7300 topcoat

G. SYSTEM I-7
1. Substrate: Gypsum Board (Epoxy Finish):
2. Manufacturers and Products:
   a. Sherwin Williams:
      1) 1st Coat: PrepRite 200 Int Latex Primer
      2) 2nd Coat: ProIndustrial Precat. WB Epoxy, S-G, Series K46
      3) 3rd Coat: ProIndustrial Precat. WB Epoxy, S-G, Series K46
   b. Benjamin Moore:
      1) 1st Coat: Super Spec HP Waterborne Polyamide Epoxy Metal Primer P42-70
      2) 2nd Coat: Super Spec HP Acrylic Epoxy Coating P43
      3) 3rd Coat: Super Spec HP Acrylic Epoxy Coating P43
   c. Glidden Professional:
      1) 1st Coat: Glidden Professional High Hide 1000 primer
      2) 2nd Coat: Devoe Coatings TRU-GLAZE WB Epoxy 4426 topcoat
      3) 3rd Coat: Devoe Coatings TRU-GLAZE WB Epoxy 4426 topcoat

H. SYSTEM I-8
1. Substrate: Concrete Floor (Sealed):
2. Manufacturers and Products:
   a. W. R. Meadows:
      1) 1st Coat: CS-309/30 Concrete Curing and Sealing Compound

PART 3 EXECUTION

3.01 SCOPE -- SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:
   1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
   2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
   3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
   4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
   5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
   6. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.
   7. Paint shop-primed mechanical and electrical items occurring in finished areas.
   8. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   9. Paint interior surfaces of air ducts and convector and baseboard heating cabinets with flat, nonspecular black paint where visible through registers, grilles, or louvers.
   10. Paint dampers exposed behind louvers, grilles, to match face panels.
   11. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

C. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
   2. Items indicated to receive other finish.
   3. Items indicated to remain naturally finished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Anodized aluminum.
   6. Polished and brushed stainless steel items.
   7. Brick, precast concrete, integrally colored plaster.
   8. Polished and brushed stainless steel, anodized aluminum, bronze, terne, and lead.
   9. Acoustical materials.
   10. Concealed piping, ductwork, and conduit.

3.02 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Architect's approval.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Board: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

E. Measure the ph factor of concrete, masonry, and mortar before starting any finishing process, using the method specified in MPI Architectural Painting Manual.
   1. Report results in writing to Architect before starting work.
   2. If results of test indicates need for remedial action, provide written description of remedial action. If a different primer or paint systems is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from Architect.

3.03 PREPARATION

A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
   1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
   2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

L. Interior Wood Items to Receive Transparent Finish: Sand wood to obtain a uniform appearance before immediately starting work. Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.
   1. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
   1. Number of coats and film thickness required are the same regardless of application method.
   2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
   3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
   1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
   2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
   3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
   4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
   5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
   6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

7. Pigmented (Opaque) Finishes: Provide smooth, opaque surface of uniform finish, color, appearance, and coverage.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.06 CLEANING AND PROTECTION

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

END OF SECTION

SECTION 10 11 01

VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Markerboards and Tackboards.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ASTM A424 - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2009a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit two samples 2 by 2 inch in size illustrating materials and finish, color and texture of markerboard, tackboard, tackboard surfacing, and trim.

E. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:
   1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
   2. Polyvision Corporation (Nelson Adams): www.polyvision.com.
   3. Aarco Products, Inc..
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

A. Markerboards: Porcelain enamel on steel, laminated to core.
   1. Color: White.
   2. Metal Face Sheet Thickness: 0.024 inch (24 gage).
   3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
   4. Backing: Aluminum foil, laminated to core.
   5. Size: As indicated on drawings.
   6. Frame: Extruded aluminum, with concealed fasteners.
   7. Frame Finish: Anodized, natural.
   8. Accessories: Provide chalk tray.

B. Tackboards: Fine-grained, homogeneous natural cork.
   1. Cork Thickness: 1/8 inch.
   2. Backing: Fiberboard, 3/8 inch thick, laminated to tack surface.
   3. Size: As indicated on drawings.
   4. Frame: Same type and finish as for chalkboard.

C. Combination Units and Units Made of More Than One Panel: Factory-assembled markerboards, and tackboards in a single frame, of materials specified above.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424, Type I, Commercial Steel, with fired-on vitreous finish.

B. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

C. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

D. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on a metal plate fastened to perimeter frame near chalkrail.

B. Chalk Tray: Aluminum, manufacturer's standard profile one piece full length of chalkboard, molded ends; concealed fasteners, same finish as frame.

C. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

3.04 SCHEDULE

A. Type A1: typical markerboard/tackboard combination, sizes as shown.

B. Type B1: Tackboard, sizes as shown.

END OF SECTION

SECTION 10 21 13.19

SOLID COMPOSITE TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Solid composite toilet compartments.

C. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, ____x____ inch in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Toilet Compartments:
   1. Basis of Design: Bobrick; Product 1090 Sierra series.
   2. Substitutions: Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Toilet Compartments: Solid molded composite panels, doors, and pilasters, floor-mounted headrail-braced.

B. Door and Panel Dimensions:
   1. Door and Stile Thickness: 3/4 inch.
   2. Door Width: 24 inch.
   3. Door Width for Handicapped Use: 36 inch, out-swinging.
   4. Panel Thickness: 1/2 inch.
   5. Height: 58 inch.
   6. Thickness of Pilasters: 1 inch.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with satin finish, 3 in high, concealing floor fastenings.

B. Head Rails: Hollow anodized aluminum tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.

C. Pilaster Brackets: Polished stainless steel.

D. Wall Brackets: Continuous type, polished stainless steel.

E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

F. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Door Latch: Slide type with exterior emergency access feature.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Accessories for toilet rooms, showers, and utility rooms.

C. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 10 21 13.19 - Solid Composite Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.

B. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products listed are made by Bobrick and Bradley Corporation.

B. Other Acceptable Manufacturers:
   1. A & J Washroom Accessories Inc: www.ajwashroom.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Substitutions: Section 01 60 00 - Product Requirements.

C. All items of each type to be made by the same manufacturer.

2.02 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

2.03 TOILET ROOM ACCESSORIES

A. Toilet Paper Dispenser: Jumbo Roll Dispenser
   1. Provided by Owner, installed by Contractor.
   2. Product: Kimberly-Clark Model No. 09608.

B. Not Used

C. Paper Towel Dispenser: Jumbo Roll Dispenser
   1. Provided by Owner, installed by Contractor.
   2. Product: Kimberly-Clark Model No. 09996

D. Electric Hand Dryer:
   1. Manufacturers:
      a. American Dryer, Inc; ExtremeAir GXT: www.americandryer.com.
      b. Excel Dryer; Product Xlerator: www.exceldryer.com.
      c. World Dryer Corporation; Product SMARTdri: www.worlddryer.com.
   2. Substitutions: Section 01 60 00 - Product Requirements.

E. Waste Receptacle: Recessed and Semi-Recessed, stainless steel, seamless lower door for access to container, reinforced panel full height of door, continuously welded bottom pan and seamless exposed flanges.
   1. Liner: Removable, heavy-duty vinyl liner, attached at a minimum of 4 points with stainless steel grommets and hooks.
   2. Minimum capacity: 12 gallons.
   3. E-1 (Recessed) Product: B-346 manufactured by Bradley.
   4. E-2 (Semi-Recessed) Product: B-346-10 manufactured by Bradley.

F. Soap Dispenser: Soap lather dispenser, wall-mounted, surface, with black ABS cover.
   1. Provided by Owner, installed by Contractor.
   2. Product: Kimberly-Clark Model No. 92148

G. Mirrors: Stainless steel framed, 6 mm thick laminated glass mirror.
   1. Series B- 290 manufactured by Bobrick.
   2. Size: shown on Drawings.
   3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.

H. Grab Bars: Stainless steel, 1-1/2 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
   1. Length and configuration: As indicated on drawings.
   2. Product: B-6806 Series manufactured by Bobrick.

I. Not Used

J. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Product: B-254 manufactured by Bobrick.

K. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Style: Horizontal.
   2. Material: Stainless steel shell with polyethylene body.
   3. Mounting: Surface.

4. Manufacturers:
   a. Bradley Corporation: www.bradleycorp.com.
   b. Koala Kare Products: www.koalabear.com.
   c. Substitutions: See Section 01600 - Product Requirements.

L. Shower Curtain Rod: Stainless steel tube, 1-1/4 inch outside diameter, 0.05 inch wall thickness, satin-finished, with 2-9/16 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for concealed mounting.
   1. Product: B-6047 manufactured by Bobrick.

M. Shower Curtain:
   1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
   2. Shower curtain hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
   3. Product: 204-2 & 204-1 manufactured by Bobrick.

N. Not Used

O. Wall-Mounted Soap Dish: Heavy duty, seamless stainless steel, recessed, without grab bar, satin finish; with concealed mechanical fastening suitable for substrate and backplate.
   1. Product: B-4390 manufactured by Bobrick.

P. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
   1. Product: B-7671 manufactured by Bobrick.

Q. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Hooks: 4, 0.06 inch stainless steel rag hooks under shelf.
   2. Mop/broom holders: 3 spring-loaded rubber cam holders under shelf.
   3. Length: 34 inches.
   4. Product: B-239 x 34 manufactured by Bobrick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

3.04 SCHEDULE

A. Toilet Paper Dispenser: Double Jumbo Rool; Provide as shown.

B. Not Used

C. Paper Towel Dispenser: Provide one for each sink in the following locations:
   1. Consession Stands

D. Electric Hand Dryer: Provide as shown in toilet rooms.

E. Waste Receptacle: Provide as shown in toilet rooms.

F. Soap Dispenser: Provide as shown in toilet rooms.

G. Mirrors: As shown in toilet rooms.

H. Grab Bars: 1-1/2 inch diameter. Provide as shown in toilet rooms.

I. Not Used

J. Sanitary Napkin Disposal Unit: Provide as shown in toilet rooms.

K. Diaper Changing Station: Provide as shown in toilet rooms.

L. Shower Curtain Rod: Provide as shown in locker room showers.

M. Shower Curtain: Provide as shown in locker room showers.

N. Not Used

O. Wall-Mounted Soap Dish: Provide as shown in locker room showers.

P. Robe Hook: Provide as shown in locker room showers.

Q. Combination Utility Shelf/Mop and Broom Holder: Provide as shown in custodial closets.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Fire extinguishers.

C. Fire extinguisher cabinets.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 04 20 00 - Unit Masonry BPD: Roughed-in wall openings.

C. Section 09 90 00 - Painting and Coating: Field paint finish.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2010.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions.

C. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. JL Industries, Inc.
   2. Larsen's Manufacturing Co.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.

3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL for the purpose specified and indicated.

B. Wet Chemical Type Fire Extinguishers: Stainless steel tank, pressurized, with low "pH" potassium acetate and potassium citrate solution including hose and nozzle.
   1. Class: K.
   2. Size: 2.5 gallon.
   3. Finish: Stainless steel.

C. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Class: A:B:C.
   2. Size: 10 pound.
   3. Finish: Baked polyester powder coat, red color.

2.03 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.
   1. Sized to accommodate accessories.
   2. Exterior nominal dimensions of ____ inch wide x ____ inch high x ____ inch deep.
   3. Trim: Flat, 3/8 inch wide face.

C. Door: 12 gage steel door, reinforced for flatness and rigidity; lock with key access. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.

D. Door Glazing: Glass, clear, 1/8 inch thick tempered. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

F. Finish of Cabinet Exterior Trim and Door: Primed for field paint finish.

G. Finish of Cabinet Interior: White enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 48 inches from finished floor to the top of the cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

3.03 SCHEDULES

A. Corridors: Water Type 2A, 2 1/2 gallon (11 L) capacity, polished chrome finish, placed in 12 inch (300 mm) wide x 30 inch (760 mm) high x 10 inch (250 mm) deep recessed polished stainless steel cabinet; locate 2 per floor.

B. Corridors: Dry Chemical Typs, 10 pound, placed in recessed field painted cabinet, as shown.

C. Kitchen and Culinary Arts Classroom: Wet Chemical Type, Class K, 2-1/2 gallon capacity, mounted on wall bracket, location as directed, one per room.

END OF SECTION

SECTION 10 51 00

LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Mobile and fixed locker units with hinged doors.

C. Metal tops and filler panels.

D. Locker benches.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete base construction.

B. Section 06 20 00 - Finish Carpentry: Finish top and end panels.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on locker types, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Team Lockers:
   1. Art Metal Products: www.artmetalproducts.com.
   2. Lyon Workspace Products: www.lyonworkspace.com.
   3. Penco Products, Inc: www.pencoproducts.com.
   4. Republic Storage Systems Co: www.republicstorage.com.
   5. WEC Manufacturing, Inc.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Baseball Lockers, (mobile and fixed):
   1. Mid-Minnesota Wire (GearGrid Product Line), 670 SW 15th Street, Forest Lake, MN 55025. Toll-free 888-643-6694. Phone 651-464-4468. Fax 651-464-4780. Web site www.geargrid.com. Email sales@geargrid.com.

2.02 MATERIALS

A. Sheet Steel: ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; to the following minimum thicknesses:

1. Body and Shelf: 24 gage, 0.024 inch.
2. Door Outer Face: 16 gage.
3. Door Frame: 16 gage, 0.060 inch.
4. Hinges: 14 gage, 0.075 inch.
5. Base: 20 gage, 0.036 inch.
6. Sloping Top: 20 gage, 0.036 inch.
7. Trim: 20 gage, 0.036 inch.

B. Accessories For Each Locker: Two single prong wall hooks, coat hanger bar.

C. Locker Benches: Stationary type; bench top of laminated birch species wood, stained, sealed and varnished; pedestals of chrome steel, 18 inches high.

2.03 LOCKER UNITS - TYPE 1 & TYPE 2 (Team Lockers)

A. Width: 24 inches.

B. Depth: 18 inches.

C. Height: 72 inches.

D. Configuration: single tier.

E. Mounting: Free standing and surface mounted.

F. Base: Fabricate for concrete base.
   1. Base Height: 4 inch.

G. Locking: Equipped for padlock hasps.

H. Ventilation Method: Expanded metal door panel.

I. Class: Conventional.

J. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.

K. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.

L. Doors: Hollow channel edge construction, 1-3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.

M. Hinges: Two for doors under 42 inches high; three for doors over 42 inches high; weld securely to locker body and door.

N. Locking device supplied by Owner.

O. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 3/4 inch high of block font style with ADA designation, in contrasting color.

P. Form recess for operating handle and locking device.

Q. Finish edges smooth without burrs.

R. Fabricate metal tops, ends and closure pieces.

S. Provide end panels and filler strips.

2.04 LOCKER UNITS TYPE 3 (Baseball Mobile Units)

A. Basis of Design: Model: GEARGRID Mobile Units:
   1. GEARGRID 6-pack unit having three openings each side back to back.
   2. 20” 6-pack unit overall dimensions: 83” high x 63” wide x 40” deep.

B. Locker Sizes:
   1. Standard 20” Opening: Overall dimension-79” high x 21.25” wide x 20” deep.
   2. Clear Opening Width: 18.75"

C. Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.

D. Vertical Dividers:
   1. Outer Frames: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
   2. Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.

E. Back Panel:
   1. Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.

F. Shelves: (1) Top, (1) Bottom. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Top shelf includes a 20 gauge steel bracket to accept a 2" x 16" name placard.

G. Apparel Hooks: (3) per opening. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed.

H. Base Assembly: Base frame shall be manufactured from 1.25" x 11 gauge wall thickness ASTM A513 square steel tubing.
   1. Each unit to be supplied with four (4) casters per unit. Casters to have a 250 lbs. capacity per each caster.
   2. Each caster is a swivel model with brake.

I. Accessories:
   1. Door:
      a. Frame: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
      b. Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
      c. Top Cover: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
      d. Hinge: Single pin welded style with brass pivot bushing.
      e. Placard Channel: 20 gauge steel to accept a 2" x 12" name placard.
      f. Latch/Hasp: Self-latching with padlock hasp. Lock by owner.

2.05 LOCKER UNITS TYPE 4 (Baseball Wall Mounted)

A. Basis of Design: Model: GEARGRID Wall Mounted Storage System.

B. Locker Sizes:
   1. Standard 20" Opening: Overall dimension-79" high x 21.25" wide x 20" deep.
   2. Clear Opening Width: 18.75"

C. Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.

D. Vertical Dividers:
   1. Outer Frames: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.

2. Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.

E. Back Panel:
1. Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.

F. Shelves: (1) Top, (1) Bottom. .25” diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Top shelf includes a 20 gauge steel bracket to accept a 2” x 16” name placard.

G. Apparel Hooks: (3) per opening. .25” diameter ASTM 510 cold drawn steel wire resistance welded and cold formed.

H. Mounting Brackets: 11 GA Steel
1. Provide wall and floor mounting brackets.
2. Finish: Match locker frame.

I. Accessories:
1. Door:
a. Frame: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
b. Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
c. Top Cover: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
d. Hinge: Single pin welded style with brass pivot bushing.
e. Placard Channel: 20 gauge steel to accept a 2" x 12" name placard.
f. Latch/Hasp: Self-latching with padlock hasp. Lock by owner.

2.06 FINISHING

A. Standard Finish: Components to be cleaned using a phosphatized bath, clear water rinse and electro-statically coated with a durable TGIC powder coating.

B. Paint locker units as follows:
1. Locker Types 1, 2, 3, and 4: Custom color: "Dover Blue"

2.07 BENCHES

A. Standard Bench: Select hardwood seat with clear lacquer finish, 9.5 inches wide by 1.25 inch thick with two heavy duty steel tube legs with flanges top and bottom, anchored to the floor.
1. Length as shown.

B. ADA Bench: 42 inch long select hardwood seat with clear lacquer finish, 20 inches wide by 1.25 inch thick with four heavy duty steel tube legs with flanges top and bottom, anchored to the floor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Place and secure on prepared base.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install accessories.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 11 40 00

FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Provide all material, labor, equipment and services required to execute and complete all items of work relating to the food service equipment, both existing and new, all as required to make the resulting facility a fully functional and reliable operating unit in accordance with this Specification. All food service equipment shall be furnished as specified, delivered prepaid, unloaded and uncrated, assembled with all components and accessories connected within the equipment, set-in-place in proper location as indicated on the drawings, leveled and fastened to the wall, ceiling or floor as required, left ready for final utility connections by the General Contractor. The work shall include:

1. To prevent extended warehousing of all food service equipment, no pre-ordering of equipment is permitted; schedule ordering of the equipment so that warehousing of the equipment shall not be required for longer than 60 days prior to delivery to the site for installation.
2. All food service equipment shall have a manufacturer extended warranty covering parts and labor for a period of two years which shall take effect only after acceptance and beneficial use by the owner. All labor shall be performed by a factory authorized and qualified representative.
3. A “complete and thorough” demonstration and start-up for each item of equipment must be conducted by a qualified manufacturer representative to the Owner's food service and maintenance personnel in the use, sanitation and maintenance of the equipment.

C. Furnishing scheduled items of custom fabricated food service equipment, as specified, utilizing a food service equipment fabricator listed with the National Sanitation Foundation (NSF) for custom equipment fabrication.

D. Delivery of food service equipment in factory fabricated containers designed to protect equipment and finish until final installation. Delivery of food service equipment shall be coordinated with the construction schedule as developed by the General Contractor. If necessary, delivery of the food service equipment shall be by means other than common carrier to expedite delivery and to maintain project schedule.

E. Warehousing of the food service equipment in a bonded warehouse and redelivery of the food service equipment from the storage facility to the project site, or arrangement for secured storage at the project site as coordinated with the Owner to assure availability of the food service equipment to maintain project schedule.

F. Field installation of the food service equipment, including buy-out equipment at the project site including on-site receiving and unloading, uncrating from packing containers, conveyance of the food service equipment from the receiving area to the installation location, erection and assembly of the food service equipment, including field welding and polishing of sub-assemblies and installation of fixtures and components, and setting-in-place in final location left ready for final utility connection by the General Contractor.

G. Removal and disposal of all packing material.

H. All costs for special tools, crane rental or usage costs or rigging as may be required for delivery or installation of the food service equipment as specified.

I. Furnish materials and install copper insulated refrigeration lines from compressor location to evaporator coils, expansion valves, etc., for all refrigeration units and ice makers specified with remote or refrigeration systems other than self-contained.

J. All work is to be performed by skilled labor utilizing the proper trades having respective jurisdiction thereto. All work shall be performed at hours required to maintain consistent work schedules with all other trades as coordinated by the General Contractor without additional cost to the Owner.

K. Preparation of dimensioned utility rough-in floor plans coordinated with the Contract Documents and site conditions and the food service equipment manufacturers' utility connection points, for all food service equipment as specified.

L. Assist the General Contractor in the preparation of "chalk-line" mark-up of utility rough-in locations on the building floor at the job site.

M. Take complete financial responsibility for any and all additional expenses that may be borne by the Owner resulting from incomplete or inaccurate rough-in drawings or instructions for the final rough-in dimensioning at the job site.

N. Provide complete manufacturers' and fabricator shop drawings of all related items of food service equipment.

O. Provide competent on-site supervision for the coordination of work with the General Contractor and to assist and supervise the erection, assembly, and installation of the food service equipment, this shall include any moving, shifting, or disassembly of the food service equipment as required to enable the General Contractor to perform its work free of obstruction.

P. Attend all job conferences and meetings as required by the Owner.

Q. Maintaining coordination and control over the form, fit, function, and utility requirements of all food service equipment, from placement of purchase orders through Final Acceptance by the Owner.

R. Provide competent on-site final testing, demonstration and instruction in the use and service of all items of food service equipment to the Owner in the form of a qualified manufacture's representative for each item of required food service equipment.

S. Providing the Owner with access to the custom equipment fabricator's shop for inspection of construction and materials used at any time during the progress of fabrication.

T. Field verification of all measurements at the project site prior to the fabrication of custom fabricated and buy-out equipment and correct any deviation from the dimensions

indicated on any plans, shop drawing, etc. which may affect the final form or fit of any item of food service equipment as a result of final building conditions and actual field dimensions.

U. All food service equipment shall conform to field verified dimensions and to the finished building conditions with edges scribed and sealed to wall surfaces, fitting to and around building obstructions, etc. All joints, seams, or surfaces shall be fully sealed with General Electric or equivalent clear silicone sealer.

V. Field verification of delivery access into and through the building to the final equipment location, including access and clearance through hallways, doorways, elevators (cab size and weight restrictions), etc. furnish food service equipment in sections or sub-assemblies as required for access.

W. Keeping the premise free from accumulation of waste material and rubbish caused by his work. At the completion of each workday all waste material and rubbish must be removed and all areas swept broom clean.

X. Physical damage to equipment, building, or previous work completed or in the process of completion shall be repaired or replaced.

Y. Furnish as part of and affixed to the food service equipment, accessories, components and fixtures furnished standard with the equipment as specified or listed as an option and shall include the following:
   1. PLUMBING ACCESSORIES: Pop-up, lever or basket type waste outlets, tailpieces, standing or connected overflows, faucets and spray units, vacuum breakers, shut-off and control valves, fittings, etc.
   2. STEAM AND GAS ACCESSORIES: Steam supply valves, thermostats, pressure reducing and regulating valves, shut-off and control valves, temperature and pressure gauges, copper steam coils or injector assemblies, traps, fittings, etc.
   3. ELECTRICAL ACCESSORIES: Terminal blocks, conduit, wiring, signal and pilot lamps, on-off and control switches, control panels, magnetic contactor assemblies, heating elements, junction boxes, outlet boxes and receptacles, cord and plug sets, etc.
   4. REFRIGERATION ACCESSORIES: Copper insulated refrigeration tubing, valves, fittings, hangers, high and low pressure control switches, solenoid valves, evaporator coils, expansion valves, condensing units, condensate evaporators, etc.

Z. All built-in accessories, components and fixtures shall be factory installed at the time of fabrication and shall comply with all applicable codes, regulations, etc.

AA. All electrical wiring, plumbing lines, gas lines (except exposed threaded pipe gas manifolds at cooking appliances), steam lines, refrigeration lines, etc. shall be concealed in the floor, walls or above the finished ceiling in an acceptable manner and in compliance with all applicable codes, etc. Where it is impractical to run lines within the floor, walls or above the finished ceiling, lines shall be enclosed in a stainless steel (or alternate “smooth and cleanable” Owner approved material with appropriate access for service or replacement. In situations of an island arrangement or where equipment is not situated with access to a wall surface, lines must be installed in the floor in an approved manner including in-ground conduit for refrigeration and beverage lines. In no case shall any lines be “exposed”.

1.02 WORK BY THE ELECTRICAL CONTRACTOR

A. Rough-in utility connections including proper voltage, phase and amperage required to satisfactorily operate all items of food service equipment.

B. Final connection of the food service equipment from the rough-in location to the connection point on all food service equipment and necessary connection points.

C. Furnish materials and install all interconnecting wiring as required for the food service equipment, this shall include inter-wiring of control panels furnished as a part of a fixture or appliance, on-off switches for light fixtures furnished as a part of a fixture or appliance, inter-wiring of control devices to motors furnished as a part of a fixture or appliance, time clock circuits for freezers from remote condensing unit to evaporator coil, heated pressure relief ports in walk-in freezer, electrical receptacles furnished as a part of a fixture or appliance, light fixtures in exhaust hoods and walk-in refrigeration to on-off switches and conduit junction boxes, inter-wiring of food waste disposer from control device to disposer motor, etc. all as required to complete the installation of the food service equipment.

D. Furnishing materials and installation of all interconnecting wiring as required for the food service exhaust ventilation and fire suppression systems; this shall include wiring of electrically operated gas supply shut-off valves for fire suppression systems, fire suppression system wiring to building fire alarm, heat detector electrical detection device to automatically start exhaust fans, supply and exhaust fans and control devices including on-off switches located in kitchen, light fixtures, etc.

E. All electrical components for the exhaust and supply ventilation system (including condensate hoods and pant leg vent systems) including, electrical disconnects, starters, exhaust fan on-off switch with indicator lights located in kitchen, supply fan controller with indicator lights located in kitchen, etc.

F. Furnish materials and install heat tracing tape to all condensate lines within walk-in freezer.

G. Furnishing and installation of all accessories, components and fixtures other than those specified as part of the food service equipment, to include but not be limited to, electrical circuit breakers or fuses, electrical receptacles, disconnect switches, on-off switches or other fittings and appurtenances that are required to connect the food service equipment in accordance with manufacturers instructions and result in proper operation.

H. Utility disconnection and termination of discontinued services of existing food service equipment to be terminated or relocated, and modification or preparation of utility services for existing food service equipment to be relocated at the new location.

I. Furnishing and installing electrical plug and cord sets where indicated.

J. Electrical contactors or shunt-trip circuit breakers to interrupt electrical power to all electrically operated food service cooking appliances.

K. In-floor, flush mounted, waterproof electrical receptacles of type and capacity to match plug and cord sets for all mobile food service counter equipment.

L. Ceiling mounted, retractable drop cords to accommodate food service equipment in an island arrangement, of the type and capacity to match plug and cord sets of the food service appliances.

1.03 WORK BY THE PLUMBING CONTRACTOR

A. Rough-in utility connections including gas, steam, hot and cold water, and floor receptors and drains in proper sizes, pressures and quantities required to satisfactorily operate all items of food service equipment.

B. Final connection of the food service equipment from the rough-in location to the

connection point on all food service equipment and necessary outlets.

C. Furnish materials and wrap and insulate with foam pipe insulation the heat tracing tape on all condensate lines within a freezer environment.

D. Furnish materials and install all interconnecting plumbing as required for the food service equipment, this shall include faucets, drains, drains with connected overflow, shut-off valves, vacuum breakers, flow or pressure control valves, gauges, bleeder tubes, piping from disposer control devise to disposer cone and disposer body inlets, piping for steam operated equipment from boiler take-off valve at steam generator to steam inlet connection at appliance, etc. all as required to complete the installation of the food service equipment.

E. Furnish materials and install interconnecting chrome plated exposed piping for hose reel and hose bibs including installation of check valves and vacuum breaker in supply line; this shall include chrome plated bleeder outlet if required by local health department regulations or local plumbing codes.

F. Furnishing and installation of all accessories, components and fixtures other than those specified as part of the food service equipment, to include but not be limited to stop cocks, traps, pipe, shut-off valves, pressure reducing valves or other fittings and appurtenances that are required to connect the food service equipment in accordance with manufacturers instructions and result in proper operation.

G. Furnishing and installing chrome plated indirect waste outlet piping for food service equipment, from the waste outlet connection on the food service equipment to the building waste receptacle (floor sink, etc.).

H. Flushing and sanitizing of lines before making final connections to the food service equipment.

1.04 WORK BY THE MECHANICAL CONTRACTOR

A. Supply and exhaust ventilation for indoor refrigeration condensing units based on 750 cfm for each air cooled compressor horsepower and 250 cfm for each water cooled compressor horsepower.

1.05 WORK BY THE GENERAL CONTRACTOR

A. Masonry bases, floor curbs, structural pads, floor depressions, roof curbs, flues and fireproof duct shafts or enclosures.

B. Installation of floor pans in floor depression with floor pans set flush and finished watertight around entire perimeter at juncture with floor surface.

C. Conduit for refrigeration lines (PVC if embedded in concrete or smooth aluminum if exposed) with 24" radius sweep bends including sleeves any through walls, floors and ceilings.

1.06 BIDDING INSTRUCTIONS AND QUALIFICATION OF BIDDER

A. Items of food service equipment described in this specification are considered the basis of design of the base bid and must be bid accordingly without exception. Any substituted item proposed as part of this bid must be submitted two weeks prior to the due date of the bid for “pre-approval” and must meet the conditions of the base bid; this shall include all materials and material finishes, fabrication methods, electrical, plumbing, and mechanical components, electrical control devices, hardware, accessories, and options, exactly as specified without exception. Submission of “pre-approved” substituted items of equipment must be submitted as a part of the base bid, including any add or deduct

price to the base bid. A determination as to the acceptability of the substituted item will be the responsibility of the owner or his designated representative. It will be the full and complete responsibility of the food service equipment contractor to pay any and all costs incurred in adapting any substituted item to the mechanical, electrical, exhaust ventilation, or structural systems of the building, or any other cost increase incurred as a result of engineering changes to the mechanical, electrical, exhaust ventilation, architectural, structural, or food service drawings. Should any item be determined not to be an acceptable substitution to the base bid, it shall be the responsibility of the food service equipment contractor to remove and replace the substituted item with the base bid item, as specified, at no additional cost to the owner. Failure to follow this instruction will disqualify the bid. The contract is to be awarded as follows:

1. The competence and responsibility of the bidder.
2. An itemized cost breakdown of each scheduled item of food service equipment is required, as specified, in order that the owner may, at his option, delete any item or supply any portion thereof, or increase the quantity of any item without affecting the cost quoted for the remaining items. "Pre-approved" substituted items must be submitted as an add or deduct alternate in addition to the base bid.
3. The owner is not obligated to accept the lowest or any other bid. The award of the contract and choice of the food service equipment contractor shall be at the Owner's discretion.

B. Each bidder shall be responsible to visit the project site of the proposed work and fully acquaint himself with conditions as they exist.

C. Each bidder is responsible to attend any pre-bid meeting as required by the owner.

D. Each bidder shall be responsible to examine and review the contract document drawings and specifications. Should the bidder find during examination of the drawings and specifications any discrepancies, omissions, ambiguities, or conflicts in or among the contract documents or shall be in doubt as to their meaning, the owner shall be notified no later than four working days prior to bid opening for clarification.

E. The failure or omission by any bidder to receive or examine any form, instrument or document or to visit the project site shall in no way relieve him from obligation with respect to his bid. No claims for any extras will be allowed due to unintentional errors, conflicts, or omissions in the contract documents drawings or specifications.

1.07 SUBMITTALS

A. Product Data: For each buy-out item of food service equipment indicated. Include manufacturer's model number and accessories and requirements for access and maintenance clearances, water and drainage, power or fuel, and service connections including roughing-in dimensions.

B. Shop Drawings: For food service equipment not manufactured as standard production and catalog items by manufacturers. Shop drawings shall include the following information:

1. Dimensioned rough-in plans scaled at 1/4"=1'-0", accurately locating connection points and indicating utility data for all mechanical, electrical, and supply and exhaust ventilation requirements, including all items of new and existing food service equipment to be reused.
2. Dimensioned plans scaled at ½"=1'-0", accurately locating and indicating the finished size of masonry bases, floor depressions in structural slabs, stub walls, curbs, and finished openings for pass-thru equipment in walls, etc.
3. Dimensioned plans and detailed drawings of all custom fabricated food service equipment scaled at 3/4"-1'-0" for plan and elevation views, and 1-½"=1'-0" for

sectional views.

C. Copies of original maintenance and repair manuals, including a list of all authorized service agencies responsible for each item of food service equipment.

1.08 QUALITY ASSURANCE

A. Manufacturer's qualifications shall include a firm that has regularly engaged in the manufacturing of food service equipment of the same type, capacity, performance, and size as specified, and whose products have been in similar service for not less than five years.

B. Custom fabricator qualifications for custom food service equipment shall include a skilled sheet metal shop with a minimum of five years experience in custom sheet metal food service equipment fabrication of similar type as specified. All custom food service equipment shall be fabricated at the same shop.

C. Installer's qualifications shall include a firm with at least three years of successful installation experience on projects with a similar scope to that as required for this project.

D. Food service equipment dealers qualifications shall include a firm which is regularly engaged in the purchasing of food service equipment as is a manufacturer authorized agent of the specified equipment for not less than five years. The dealer shall also employ a full time project management staff to oversee the purchase of the equipment in compliance with the specifications, coordinate the form and fit of the equipment to the project site conditions, attend all project meetings, coordinate shop drawing review, coordinate installation with the trades, coordinate factory training, and address all issues as they relate to the satisfactory completion of the facility in compliance with the specifications and related documentation.

E. Codes and Standards: All food service equipment furnished and installed under this specification shall be manufactured in strict compliance with the following publications or the current or revised related publication as well as all state, national, and local codes and agencies having jurisdiction over same:
   1. National Electrical Manufacturer Association NEMA
      a. ICS-77 Industrial Controls and Systems
   2. National Fire Protection Association NFPA
      a. 12.1 General Information and Requirements
      b. 17.4 Local Application System
      c. 17.13 Water Sprinkler Systems
   3. National Sanitation Foundation NSF
      a. 11-76 Food Service Equipment
      b. 4-73 Commercial Cooking and Warming Equipment
      c. C-2-72 Special Equipment and/or Devices
   4. Underwriters Laboratories UL
      a. 57-78 Electric Lighting Fixtures
      b. 197-78 Commercial Electric Cooking Appliances
      c. 300 Fire Extinguishing Systems
   5. International Mechanical Code 2006 (IMC)
   6. 2009 Federal Regulations for Refrigeration

F. All food service equipment shall be manufactured in strict compliance with standards as set forth by the National Sanitation Foundation (NSF), including fabrication of custom built equipment and shall be listed with same and shall bear their seal. Any item of food service equipment lacking the NSF seal will be rejected.

G. All electrically operated food service equipment shall be constructed in strict compliance with standards as set forth by the Underwriters Laboratories (UL) and shall utilize approved components and assemblies and shall bear the label thereof.

H. Custom fabricated food service equipment shall be constructed to the standards as set forth by the National Association of Food Equipment Manufacturers (NAFEM).

I. All refrigeration equipment and all pressurized vessels shall be constructed, approved, inspected, registered and stamped and installed in strict compliance with the American Society of Mechanical Engineers (ASME), state and local codes for Unfired Pressure Vessels, and all other agencies having jurisdiction thereof.

J. Product Options: Drawings indicate food service equipment based on the specific products indicated. Other manufacturers' equipment with equivalent size and performance characteristics may be considered.

K. Pre installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section “Project Meetings.” Review methods and procedures related to food service equipment including, but not limited to, the following:
   1. Review access requirements for equipment delivery.
   2. Review equipment storage and security requirements.
   3. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
   4. Review structural loading limitations.
   5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver food service equipment as factory-assembled units with protective crating and covering.

B. Store food service equipment in original protective crating and covering and in a dry location.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on Shop Drawings and Coordination Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.11 COORDINATION

A. Coordinate equipment layout and installation with other work, including light fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate location and requirements of service-utility connections.

C. Coordinate size, location, and requirements of concrete bases, positive slopes to drains, floor depressions, and insulated floors. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section “Cast-in-Place Concrete”.

D. Coordinate installation of roof curbs, equipment supports, and roof penetrations, as specified in Division 7 Section “Roof Accessories”.

1.12 WARRANTIES

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. All buy-out food service equipment herein specified shall have all parts and labor warranted, in writing, from the date of Final Acceptance by the Owner against defective parts, materials, workmanship, and design for a period of time as stated within the manufacturers standard published warranty, but no less than two years.

C. All custom fabricated food service equipment shall be warranted as stated above except for a period of two years.

D. Refrigeration equipment shall include start-up and two year parts and labor warranty on the entire refrigeration system and manufacturers five year parts warranty on hermetic and semi-hermetic sealed compressors.

PART 2 - PRODUCTS

2.01 MATERIALS AND WORKMANSHIP

A. Stainless steel shall be type 302 or type 304 extra low carbon non-magnetic austenitic 18% chrome, 8% nickel alloy steel. Gauges shall be U.S. Standard of Thickness set forth below:

GAUGE	THICKNESS	GAUGE	THICKNESS
10	.1346	16	.0598
11	.1196	18	.0478
12	.1046	20	.0359
14	.0747	22	.0299

B. All sheets shall be of maximum length to permit fabrication from one sheet. All thickness must meet the above gauge thickness within tolerances set forth by the ANSI after polishing. Finished sheets exceeding these tolerances shall be rejected as not meeting this Specification.

C. Galvanealled steel shall be ARMCO steel or an approved grade of copper bearing steel. All exterior galvanealled parts, exposed members of framework, and wrought steel pipe shall be properly primed, degreased and finished with two coats of synthetic aluminum bronze.

D. Structural steel members used for framing, consisting of angles, bands, bars, and channels, shall be ductile in quality, free of hard spots, runs, checks, cracks, and other surface defects, and shall be smooth galvanized by the hot dip process with all surplus removed, free of runs, blisters, excess splatter, and uncoated spots or patches.

E. White metal shall consist of corrosion resistant metal containing not less than 21% nickel. All castings shall be rough ground, polished and buffed to a bright luster and shall be free from pit marks, runs, checks, burrs, and other imperfections.

F. Stainless steel pipe and tubing shall be seamless or welded of gauge specified and of true roundness. Seamless tubing shall be thoroughly and correctly annealed and ground smooth. Welded tubing shall be thoroughly heat treated and properly quenched to eliminate carbide precipitation, drawn true to size and roundness and polished to match stainless steel sheets.

G. Welding shall be of the electric submerged or concealed arc type, heliarc wherever practical. Where welding rods are required, they shall be of the same composition as materials to be joined, coated with a non-carbonaceous flux.

H. Plywood and Lumber: Close grain exterior grade mahogany or birch plywood.

I. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that, when cured and washed, meets requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food.
   1. Color: As selected by Architect from manufacturer's full range of colors.
   2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

J. Plastic: Except for plastic laminate, provide plastic materials and components complying with NSF 51.

K. Sound Dampening: NSF-certified, nonabsorbent, hard drying, and sound-deadening coating. Provide coating compounded for permanent adhesion to metal in 1/8-inch (3-mm) thickness that does not chip, flake, or blister.

L. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds.

2.02 ACCESSORIES

A. Cabinet Hardware: Provide NSF-certified, stainless steel hardware for equipment items as indicated.

B. Casters: NSF-certified, standard-duty, stainless-steel, swivel stem casters with 5-inch (125-mm) diameter wheels, polyurethane tires with 1-inch (25-mm) tread width, and 300-lb (90-kg) load capacity per caster. Provide brakes on 2 casters per unit.

2.03 FABRICATION

A. All welds shall be strong and ductile, nonporous, free of pits and cracks. Parts, which are to be welded, shall be homogeneous, of a like color and finish to adjoining material. Excess metal and carbide precipitation shall be ground off, finished smooth and polished. Unexposed welds shall be pacified to prevent attrition. Brazed or soldered joints are unacceptable. Where galvanizing has been damaged due to the welding or grinding process, these areas shall be galvawelded to replace finish.

B. All exposed surfaces of the food service equipment shall be free from bolts, screws, and rivet fastenings. Wherever bolts are required, they shall be of similar composition and finish as the metal to which they are applied.

C. Wherever practical, all food service equipment and fixtures shall be factory or shop fabricated of one-piece construction, shipped to the project site as one unit, completely assembled.

D. Items of food service equipment or fixtures too large to enter or transverse the building to the installation location in one assembly shall be constructed in sections and shall be furnished with field joints. Where field joints are necessary, all adjoining exposed surfaces shall be field welded at the project site as specified above for welding. Where conditions make welded field joints impractical, each sub-assembly shall be fabricated with off-set draw angles welded to the underside of each adjoining top surface and drawn together to a “hairline” seam with 1/4"-20 stainless steel bolts with lock washers and chrome plated acorn nuts. Bolted field joints will be permitted only where specifically shown on Drawings or specified for a particular item.

E. Wherever shear edges occur they shall be free of burrs, fins, or irregular projections and shall be finished to prevent cutting or laceration when the hand is drawn over such shear edges. Brake bends shall be free of undue and where such bends do mar the uniform

surface appearance of the material, such marks shall be removed by suitable grinding, polishing, and finishing. In no case where miters or bullnose corners occur is overlapping materials acceptable.

2.04 GENERAL FABRICATION STANDARDS

A. TOPS
   1. Tops shall be fabricated of 14 gauge stainless steel, unless otherwise specified. All edges shall be bullnose or formed as specified with all joints butt-edged and electrically welded ground smooth and polished so no evidence of welding will appear. Soldered corners to achieve round corner construction will not be accepted.
   2. Tops adjacent to walls, columns, or other equipment shall be turned up integrally into a backsplash as specified. All interior corners shall be coved on a 3/4“radius, both horizontally and vertically, forming spherical corners. Ends of backsplashes shall be fully enclosed to the low point of the top edge, fully welded, ground smooth and polished.

B. SUPPORT FRAMING
   1. Around the entire perimeter on the underside of all tops and set back 1" from the down-turned edge shall be a fully welded frame assembly fabricated of 1-1/2" x 1-1/2" x 1/8" galvanized angle iron, or material as specified. Provide intermediate cross bracing fabricated of the same material as the angle framing and fully weld to perimeter frame on centers not to exceed 24". Tack weld the entire frame assembly to the underside of the top surface.

C. SINKS
   1. Sinks shall be fabricated of 14 gauge stainless steel with all interior corners coved on a 3/4“ radius, both horizontally and vertically, forming spherical corners.
   2. Exposed edges of sink shall be finished with a 1-1/2" diameter, 180 degree rolled edge, rear and sides adjacent to adjoining surfaces shall have a backsplash turned up 10" high at a 90 degree angle on a 3/4" radius, and turned back 2-1/2 " on a 45 degree angle, then down 1/2" at 90 degrees along back.
   3. Multiple sink compartments shall be divided with double wall, 14 gauge stainless steel partitions, 1" wide, rounded to a 3/4" radius on top and all corners. Finish bottom, back and front with 14 gauge stainless steel to form one continuous sink with no overlapping joints or open spaces between sink compartments.
   4. Integral drainboards shall be constructed of 14 gauge stainless steel. The front portion shall continue the 1-1/2" diameter, 180 degree rolled rim of the sink bowl on a continuous level horizontal plane. The surface of the drainboard shall be pitched from 2-1/2" at the end away from the sink to 3" at the sink bowl. Sink and drainboard backsplash shall be continuous and level on the horizontal plane. All interior corners, both vertical and horizontal shall be coved on a 3/4" radius. Drainboards shall be reinforced with 1" x 4" x 1", 12 gauge stainless steel “hat” channels, extending front to rear, tack welded to underside of drainboard, for weld anchoring leg gussets.
   5. Provide cross rails extending front to rear between legs, cross rails shall not extend along rear at sink to prevent interference with plumbing.
   6. Built-in sink compartments shall be fabricated as an integral part of fixture with sink fully welded with adjacent top, weld ground smooth and polished.

D. PAINTING
   1. Galvanized steel shall be cleaned and degreased with mineral spirits, primed with a minimum of two coats of primer, and spray finished with a minimum of two coats of gray epoxy enamel paint.

2.05 STAINLESS STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
   1. Remove or blend tool and die marks and stretch lines into finish.
   2. Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
   3. Concealed Surfaces: Minimum of 80 grit finish.
   4. Exposed Surfaces: No. 4 finish (bright, directional polish), of 180 grit.
   5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   6. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, service-utility connections and other conditions affecting installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine roughing-in for piping, mechanical and electrical systems to verify actual locations of connections before installation.

3.02 INSTALLATION

A. Set each item of fixed food service equipment securely in place, level and adjust to correct height. Anchor to supporting surface where required for sustained operation and use without shifting or dislocation. Provide concealed anchoring where possible. Adjust work surfaces to a level tolerance of 1/16" maximum offset and slope drainage surfaces at 1/16" per foot.

B. Complete field assembly of field joints by welding or bolting utilizing the method as indicated with the fixture. Grind all field welds smooth and polish. Set and trim all gaskets to be installed as part of field assembly.

C. Treat enclosed spaces that are inaccessible after food service equipment installation by covering all horizontal surfaces with powdered borax at a rate of 4 ounces per square foot.

D. Provide closure trim pieces fabricated of 16 gauge stainless steel or of material and finish as specified, trim shall be one piece constructions furnished to seal both horizontal and vertical junctures and openings where the conditions given below occur:

E. Food service equipment is installed into wall openings. Trim shall apply to both sides of wall opening with all corners fully welded, ground smooth and polished.
   1. Two or more items of food service equipment are butted together.
   2. Food service equipment is installed against wall, columns, other equipment, etc. resulting in a gap or juncture exceeding 1/4" in width.
   3. An open gap of any size between the juncture or joint between adjoining items of food service equipment, wall or column surfaces, etc. which might result in the penetration or collection of grease or vermin.

F. Provide cut-outs and openings in food service equipment as required to extend plumbing, electric, steam or gas lines through the food service equipment either for interconnection of utility lines or final connection.

G. Seal around each item of food service equipment with sealant for gaps or spaces less than 1/4" in width and with stainless steel trim for gaps or spaces exceeding 1/4" in width. Closure strips shall conform to the shape and size of the surfaces or juncture to be sealed and shall be neatly scribed for a tight fit.

3.03 PROTECTION AND CLEANING

A. Provide final protection and maintain conditions in a manner acceptable to Owner, Manufacturer and Installer that ensure food service equipment is without damage or deterioration at the time of Substantial Completion.

B. After completion of the food service equipment installation and completion of other major work in the food service area remove protective coverings and clean and sanitize all food service equipment both internally and externally. Restore exposed and semi-exposed finished to remove abrasions or other surface damage polish exposed metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored.

3.04 COMMISSIONING

A. Delay start-up of the food service equipment until utility services have been installed, completed, and tested, balanced, and adjusted for pressure, voltage, etc. and until water and steam lines have been treated and cleaned for sanitation. Before start-up of the food service equipment lubricate in accordance with manufacturers instructions.
   1. Coordinate food service equipment start-up with service-utility testing, balancing and adjustments. Do not operate steam lines before they have been cleaned and sanitized.
   2. Remove protective coverings and clean and sanitize equipment both inside and out and re-lamp equipment with integral lighting. Where applicable, comply with manufacturer's written cleaning instructions.

B. Provide on-site demonstration and formal technical training by the manufacturer's technical representative for each item of food service equipment as required to instruct the Owner and its personnel in the safe operation and sanitation and maintenance of the food service equipment.

C. Test each item of food service equipment for proper operation.
   1. Repair or replace equipment that is defective in operation including units that operate below required capacity or that operate with excessive noise or vibration.
   2. Test refrigeration equipment's ability to maintain specified operating temperature under heavy-use conditions. Repair or replace equipment that does not maintain specified operating temperature.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   4. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.
   5. Test water, drain, gas, steam, oil, refrigerant and liquid-carrying components for leaks. Repair or replace leaking components.
   6. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance for each food service equipment item.

7. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout".
8. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data".
9. Schedule training with Owner through Construction Manager with at least seven days advance notice.

3.05 SCHEDULE OF EQUIPMENT

A. Equipment Schedule: Refer to all Contract Documents pertaining to the food service areas. Equipment itemized along with brands and model numbers and salient features establish the standard for construction, operation and engineering criteria.

B. Equipment indicated below is intended to establish the standard of quality of the food service equipment. Alternate products by other manufacturers may be considered if equivalent in design, performance, durability and function.

C. As a condition of this specification, the Food Service Equipment Contractor is required to participate in the review and approval of all contract documents (rough-in drawings, manufacturer's shop drawings, brochure booklets, etc.) at the office of the Food Service Consultant (1001 Baltimore Pike, Lower Level, Springfield, PA. 19064). Upon completion of each review process, the Food Service Equipment Contractor will distribute all documents in a timely manner as directed by the General Contractor.

Item No: 1

Quantity: 2
Description: Prep Table with Double Sink
Mfg: Advance Tabco
Model No: DL-30-72, TA-61 (sink on right)
Supplemental Information:

14 gauge stainless steel top, Type 304, with no-drip edge, 10 inch backsplash, satin finish, sound deadened. Stainless steel sinks integrally welded to top, (16"x20"x8") and (16"x20"x4"). Stainless steel perforated drain basket at shallow sink.

18 gauge stainless steel shelf, Type 430, satin finish, cast aluminum clamps to secure shelf to legs.

Legs: 1-5/8 inch diameter, tubular stainless steel with 1 inch agjustable stainless steel bullet feet.

Item No: 2

Quantity: 1
Description: Prep Table with Double Sink
Mfg: Advance Tabco
Model No: DL-30-72, TA-61 (44" length)
Supplemental Information:

14 gauge stainless steel top, Type 304, with no-drip edge, 10 inch backsplash, satin finish, sound deadened. Stainless steel sinks integrally welded to top, (16"x20"x8") and (16"x20"x4"). Stainless steel perforated drain basket at shallow sink.

18 gauge stainless steel shelf, Type 430, satin finish, cast aluminum clamps to secure shelf to legs.

Legs: 1-5/8 inch diameter, tubular stainless steel with 1 inch agjustable stainless steel bullet feet.

Item No: 3

Quantity: 3
Description: Wall Mounted Hand Sinks
Mfg: Advance Tabco
Model No: 7-PS-60
Options:
14" wide x 10" front-to-back x 5" deep bowl, 20 gauge stainless steel construction with 4" O.C. splash-mounted gooseneck faucet with aerator, basket drain, wall bracket.
Heavy gauge type 304 series stainless steel.
Offset galvanized wall mounting bracket.
Fittings are chrome plated brass.
Supplemental Information:
Furnish stainless steel mounting hardware of proper type for wall construction and to sustain weight while in use.
General contractor shall provide wall blocking as required for mounting.

Item No: 4
Quantity: 6
Description: Double Door Reach In Refrigerators
Mfg: Continental Refrigerator
Model No: 2RE-SS
Options:
6 ea. Self-Contained refrigeration, 1/3 hp, standard
Standard warranty: 1 year parts and labor; 5 year compressor
Stainless steel case back including rear grill & concealed drain
Model 45249CP Thermometer Digital Reading, externally mounted
Model 45247CP Alarm, high/low battery backup (°F)
5" Casters, standard
6 Shelves, epoxy coated, plated steel w/clips.

Item No: 5
Quantity: 1
Mfg: Scotsman
Model No: C1448SA-3
Options: 1 ea 3 year parts & labor warranties
5 year parts & labor warranties on Evaporator
5 year parts on compressor and condenser
Model KVS Prodigy™ Vari-Smart™ Ice Level Control
Model KSBU Prodigy SmartBoard
Model B530S Ice Bin, w/top-hinged front-opening door
Model KLP8S Leg Kit, 6", stainless steel
Model KHOLDER Ice Scoop Holder
Supplemental Information:
Plumbing contractor shall install ice machine filter system in water supply line and furnish and install interconnecting piping between water filter and ice machine water inlet.

Item No: 6
Quantity 3
Description: Stainless steel service counter.
Mfg: Custom Fabricated
Supplemental Information:
Two curved, one straight (alternate), 16 gauge stainless steel countertop with 4" integral backsplash.

Fabricate as shown on drawings with galvanized steel angle support.
Extend counter under coiling counter OH doors at service windows.

END OF SECTION 114000

SECTION 11 68 20

OUTDOOR ATHLETIC EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Provide all equipment and materials, and do all work necessary to furnish and install the Outdoor Athletic Equipment, as indicated on the drawings and as specified herein.

1.02 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this section. Other specification sections that directly relate to work of this Section include, but are not limited to:
   1. Division 31 00 00 - Earthwork; Excavation and Backfill and establishment of subgrade elevations.
   2. Section 32 12 16 - Asphalt Concrete Pavement
   3. Section 32 18 23 - Synthetic Track Surfacing
   4. Section 32 18 25 - Synthetic Field Surfacing
   5. Section 03 30 00 - Cast-in-Place Concrete; Concrete foundations and bases for goals.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
   1. U.S. Tennis Court and Track Builders Association
   2. National Federation of State High School Associations (NFSHSA)
   3. National Collegiate Athletic Association (NCAA)
   4. International Amateur Athletic Foundation (I.A.A.F.)
   5. Manufacturers Data and Recommended Installation Requirements.

1.04 SUBMITTALS

A. Manufacturers Product Data
   1. Provide manufacturer's product literature, technical specifications and other data prior to actual field installation work for Architect or Owner's Representative review.

B. Shop Drawings
   1. Provide drawings of manufacturers recommended installation and foundation requirements prior to actual field installation work for Architect or Owner's Representative review.

1.05 QUALITY ASSURANCE

A. Manufacturers warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Materials delivered to the site shall be examined for concealed damage or defects in shipping. Any defects shall be noted and reported to the Owner's Representative.

B. Replacements, if necessary, shall be immediately re-ordered, so as to minimize any conflict with the construction schedule.

C. Sound materials shall be stored above the ground under protective cover or indoors so as to provide proper protection.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. See drawings for sizes and locations.

B. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment; comply with requirements of contract documents.

C. Hardware: Heavy duty steel hardware, as recommended by manufacturer.

D. Electrical Wiring and Components: Comply with NFPA 70; provide UL-listed equipment.

E. Structural Steel Fabrications: Welded in accordance with AWS D1.1/D1.1M, using certified welders.

2.02 MANUFACTURERS

A. Outdoor Athletic Equipment Manufacturers:
1. ACO Polymer Products, Inc.
   P.O. Box 245
   Chardon, OH 44024; (800) 543-4764
2. Aluminum Athletic Equipment Co. (AAE);
   1000 Enterprise Drive,
   Royersford, PA 19468; (800) 523-5471.
3. Daktronics
   201 Daktronics Dr.
   Brookings, SD 57006-5128; (800) 325-8766
4. Edwards Sports Products Ltd,
   Units 8-9 Hounsell Building, North Mills,
   Bridport, Dorset, DT6 3BE, Tel: 01308 424111; Email: sales@edsports.co.uk
5. Nevco, Inc.
   301 East Harris Avenue
   Greenville, IL 62246-2151; (800) 851-4040.
6. Sportsfield Specialties Inc.
   P.O. Box 231, 41155 State Highway 10
   Delhi, NY 13753; (888) 975-3343; www.sportsfieldspecialties.com
7. Tomark Sports, Inc.
   P.O. Box 1088
   Corona, CA 92878

B. Manufacturers and product selections named in the following articles are provided to establish the minimum standard. Subject to compliance with the stated atributes of the Basis of Design, products of manufacturers listed above, or other manufacturers, may be submitted as a request for substitution. Refer to Section 01 60 00 - Product Requirements.

2.03 COMBINATION FOOTBALL/SOCCER SYSTEM:

A. BASE: SG4980HS GoalPak® as manufactured by Sportsfield Specialties Inc. (Basis of Design).

B. COMPONENTS:
1. Football Goal Post(s):
   a. Gooseneck support fabricated of 6.0 inch Schedule 40 aluminum pipe (6.625 inch OD), 5.0 ft radius, 8.0 ft. offset.
   b. Crossbar fabricated of 6.0 inch Schedule 40 aluminum pipe (6.625 inch OD).
      1) Length: 23 ft. 4 in.
      2) With internal rotating sleeve for upright adjustment.
   c. Uprights fabricated of extruded 6061 T6 aluminum tube (4.0 inch OD) with rigid wire loop at upper end
      1) Length: 20.0 ft.
   d. Powder Coat Finish: Yellow or White
   e. Installation package consisting of the following components:
      1) Ground sleeve: 8.0 inch hot-dipped galvanized Schedule 40 steel pipe, 5 ft. long.
      2) Access frame: SG2SGP fabricated of .125 inch aluminum, 22.25 inch square, 6.0 inch high, with eight anchor bolts.
      3) Filler plugs fabricated of 0.5 inch pressure treated plywood and .1875 inch (3/16") aluminum.
   f. Accessories:
      1) Directional wind flags.
      2) Touch-up paint (powder coat specific).
      3) Stainless steel assembly bolts, and nuts.
2. Square Post Soccer Goal(s):
   a. Crossbar fabricated of 6061 T6 extruded aluminum tube, 4.0 inch square x 0.188 inch thick, having the following attributes:
      1) Length: 24.0 ft.
      2) Radiused Outside Corners
      3) 7 Ga. Steel Crossbar Attachment Brackets
      4) Powder Coated White
      5) End Frame fabricated of 6061 T6 extruded aluminum tube having the following attributes:
         (a) Corner Upright Posts, 4.0 inch square x 0.188 inch thick.
         (b) Rolled Side Frame, 2.0 inch x 3.0 inch x 0.125 inch, Tig Welded to Corner Upright Posts.
         (c) Radiused Outside Corners
         (d) Powder Coated White
      6) Ground Bar fabricated of 6061 T6 extruded aluminum tube, 2.0 inch square x 0.250 inch thick having the following attributes:
         (a) Powder Coated White.
      7) Accessories:
         (a) Welded Aluminum Net Clips; Guaranteed for life.
         (b) Polypropylene Soccer Net: Color selected from standard net colors.
         (c) Associated Stainless Steel Hardware
3. Soccer Goal Portable Wheel Mobility Kit:
   a. Soccer Goal Wheel Insert
      1) Welded 13 Ga. Stainless Steel Frame
      2) Ultra High Molecular Weight Plastic Wheel
      3) All Stainless Steel Hardware
   b. Soccer Goal Mobility Handle:
      1) Aluminum Frame
      2) All Stainless Steel Hardware
      3) Powder Coat: White
4. Soccer Goal Back Bar Safety Clamp Kit:

a. Safety Clamp on Turf Field:
   1) Fabricated of (0.187 inch) 3/16 inch Aluminum
   2) Powder Coated White
   3) Stainless Steel Hardware
b. Anchor Pin System for natural grass practice field.

2.04 PRACTICE FOOTBALL GOAL POSTS

A. Model # GP4300 Football Goal Post - Ground Sleeve Mounted as manufactured by Sportsfield Specialties, Inc. (Basis of Design).

B. Gooseneck support: fabricated of 6” Schedule 40 aluminum pipe (6.625in OD), 5.0ft radius, 6.0ft offset.

C. Crossbar: fabricated of 6” Schedule 40 aluminum pipe (6.625in OD).
   1. Length: 23ft 4in
   2. With internal rotating sleeve for upright adjustment that utilizes precision fit textured mating surfaces, for locking into the vertical position.

D. Uprights: fabricated of extruded 6061 T6 aluminum tube (4.0in OD) with rigid wire loop at upper end
   1. Length: 20.0ft

E. Powder Coat Finish: Yellow or White

F. Installation package consisting of the following components:
   1. Ground sleeve: 8.0 inch Schedule 40 steel pipe, 5.0ft long
   2. Access frame: fabricated of 0.125 inch aluminum, 22.25 inch square, 6.0 inch high, with eight anchor bolts, filler plugs fabricated of 0.5in pressure treated plywood and 0.1875 inch (3/16") aluminum.

G. Accessories:
   1. Directional wind flags.
   2. Touch-up paint (Powder Coat Specific).
   3. Assembly bolts, and nuts- Stainless Steel

2.05 SOCCER

A. Model # SG4900 Soccer Goal as manufactured by Sportsfield Specialties, Inc. (Basis of Design).

B. Square Post Soccer Goal, refer to 2.03, B.2, B.3 and B.4.

C. Provide Anchor Pin system for natural grass installation.

D. Provide turf covered safety system at artificial turf installation. Refer to 2.03, B.4.
   1. Product: Model # SG2S as manufactured by Sportsfield Specialties, Inc.

2.06 BASEBALL/SOFTBALL

A. Baseball/Softball Aluminum Foul Pole:
   1. Foul Pole 4” o.d. x .226” wall reinforced 6061T6 extruded aluminum tube.
      a. Baseball: 20'-0" high (24'-0” overall).
      b. Softball: 15'-0" high (19'-0” overall).
   2. Frame 1.900” od. x .125” wall extruded aluminum tube, 2' x 10'-2 1/2” welded frame, 1-1/2” sq. x 3/16” thick aluminum lockcrimp mesh.
   3. Finish: Powder-coated yellow.
   4. Ground Sleeve 4.350” o.d. x .100” wall x 48” long aluminum tube,
   5. Hardware: Stainless steel.
   6. Product:

a. Baseball Model # LGFPW420 manufactured by Sportsfield Specialties Inc. (Basis of Design).
b. Softball Model # LGFPW415 manufactured by Sportsfield Specialties Inc. (Basis of Design).

B. Home Plate With Anchor:
1. Professional homeplate with ground anchor
2. Product: Model 310-shp manufactured by Bolco. (Basis of Design).

C. Anchor Bases:
1. One-piece, all rubber construction with modular heavy-gauge non-collapsible textured white rubber.
2. Universal aluminum hollow stanchion anchor adaptable with male stake and female ground receptacle.
3. Set includes: 3 bases, 3 anchors & 3 plugs. 15” x 15” x 3”
4. Products:
a. Model # TB-K13348, 100-ML Bases manufactured by Bolco. (Basis of Design).

D. Pitcher's Rubber:
1. 24" Dual Stanchion Pitching Rubber with anchor system.
2. Product: Model #02908 Import Double Stanction Baseball Pitching Rubber provided by Sports Advantage. (Basis of Design).
3. Alternate Product: Model LBMPR224 Baseball Pitching Rubber manufactured by Schutt Sports.

E. Tension Netting:
1. Product: Model # TFBSS-TN manufactured by Sportsfield Specialties Inc. (Basis of Design).
a. Baseball: 40' high custom backstop.
b. Softball: 30' high custom backstop.

F. Batting tunnel:
1. Overhead style Long Gone™ batting tunnel manufactured by Sportsfield Specialties, Inc. (Basis of Design).
a. Baseball: Triple Batting Tunnel No. LGOBT-BT-P.
b. Softball: Double Batting Tunnel No. LGOBT-SD-P.
2. Upright fabricated with 4” O.D. x 1/8” Wall Aluminum Tube:
a. Height above ground = 15'-11”
b. Powder Coat Option
3. Crossbar fabricated with 4” O.D. x 1/8” Wall Aluminum Tube:
a. 199.750” Length
b. Powder Coat Option
4. Arm-D fabricated with 2” X 2” X 1/8” Square Aluminum Tube and 4” Schedule 40 Aluminum Pipe:
a. Aluminum Mill Finish, with Powder Coat Option
5. Ground sleeves fabricated with 4.30” O.D x 4.10” I.D. Aluminum Tube:
a. 30” Length
b. Aluminum Mill Finish
c. Ground Sleeve Caps included
6. Baseball /Softball Batting Tunnel Net:
a. #36 Black Nylon 1-3/4" Mesh
1) Baseball: Three nets 14' W x 13' H x 75'L.
2) Softball: Two nets 14' W x 13' H x 55'L.
7. Hardware Kit

a. Stainless Steel Assembly Hardware
b. Quick-Clips for Net Attachment
c. Tethers
1) Black Vinyl Coated Wire Rope

G. Baseball Windscreen, Distance Banner, Batter's Eye:
1. Windscreen: Diamond Weave Mesh, Black, Model # Wind 538 manufactured by Nylon Net Co.
2. Distance Banner: Heavy duty 16 oz vinyl banner with 24" nnumbers on 38" x 56" banner.
a. Product: Model # TB-K13407 manufactured by Tomark Sports. (Basis of Design).
3. Batter's Eye: 30' H x 60' W Windscreen, Model # SSI-TAO-0-CSTM manufactured by Sportsfield Specialties, Inc. (Basis of Design).

H. Softball Windscreen with Distance Banner:
1. Heavy-duty open-mesh, vinyl coated Mesh fabric windscreen
a. Product: Model 6' high, black FencePro TB-K15246 manufactured by Tomark Sports. (Basis of Design).
2. Distance Banner: Heavy duty 16 oz vinyl banner with 14" nnumbers on 27" x 36" banner.
a. Product: Model # TB-K13456 manufactured by Tomark Sports. (Basis of Design).

I. Fence Guards: Enduro Fence Topper, Blue, Model # TB-K35625 manufactured by Tomark Sports. (Basis of Design).

J. Baseball Home Plate Halo and On-Deck Circles:
1. 10' Halo DiamondTurf Mat, Product: Model # TB-K13173 manufactured by Tomark Sports. (Basis of Design).
2. 6' Dia. Supreme DiamondTurf Logo On-deck Circle, Product: Model # TB-K13199 manufactured by Tomark Sports. (Basis of Design).

K. Helmet & Bat Storage: Long Gone "Cubby", 90" x 60" x 36" manufactured by Sportsfield Specialties, Inc. (Basis of Design).

L. Clay Bricks: 4" x 8" x 2-1/2" clay bricks:
1. Product: Model # TB-K15228 manufactured by Diamond Master, Inc. (Basis of Design).

M. Warning Track and Infield Surface:
1. Warning Track: Model # DT Warning Track Mix, 6" thickness, manufactured by Diamond Tex.
2. Infield and Bullpens: Model # DT Professional Mix, 6" thickness, manufactured by Diamond Tex.
3. Infield Conditioner: Model # DP Red Infield Conditioner, 1/2" thickness, manufactured by Diamond Pro.

2.07 FIELD HOCKEY

A. Goals: 12'-4"' wide, 7'-2"' high, 4'-0" depth.
1. 2" square slotted structural aluminum extrusion with rounded outside corners.
2. Continuous positive net attachment.
3. Heli-arc welded one-piece construction goal mouth and rear frame.
4. 18" high bottom boards bolted to welded, reinforced aluminum framework with all stainless steel hardware.
5. Goal mouth features a white powder-coated finish.

6. Product: Model #FHG01 Field Hockey Goal as manufactured by Sportsfield Specialties Inc. (Basis of Design).

B. Accessories:
1. Black Nylon Net
2. Stainless Steel Assembly Hardware
3. FHG-WK SG Field Hockey Goal Wheel Kit
4. FHC-CLAMP SG2S Safety Ground Clamp System on Turf Field.

2.08 LACROSSE GOALS

A. Provide Model # LCG01 Lacrosse Goal as manufactured by Sportsfield Specialties Inc. (Basis of Design).

B. Frame:
1. Uprights and Top Bar Fabricated of 1.50in Schedule 40 Steel Pipe, Tig Welded
2. Powder Coat: Orange

C. Ground Bar:
1. Fabricated of Steel Bar, Tig Welded
2. Powder Coat: Orange

D. Accessories:
1. Standard White Nylon Net
2. Stainless Steel Assembly Hardware
3. Anchoring pins.

2.09 TRACK AND FIELD

A. Pole Vault :
1. Landing Pad with Skirted Breather Cover
   a. Product: Model # SPV-30XL manufactured by AAE. (Basis of Design).
2. Side Pads:
   a. Product: Model # PVB-32XL manufactured by AAE. (Basis of Design).
3. Weather Cover
   a. Product: Model # SWC-30XL manufactured by AAE. (Basis of Design).
4. High School Pole Vault Standards
   a. Product: Model # PVS-HSX manufactured by AAE. (Basis of Design).
5. Pole Vault Crossbars
   a. Product: Model # XG5 manufactured by AAE. (Basis of Design).
6. Vault Box Collar
   a. Product: Model # VBC manufactured by AAE. (Basis of Design).
7. Mechanical Measuring Bars
   a. Product: Model # AMB-6 manufactured by AAE. (Basis of Design).
8. Crossbar Lifters
   a. Product: Model # ALT-20 manufactured by AAE. (Basis of Design).

B. Long Jump Pit Form:
1. Polymer concrete curbing with thermoplastic elastomer (TPE) rubber cap (white) and sand catcher.
2. Provide cover panels with recessed handles and top surface to accept synthetic track surfacing.
3. Provide jump pit assembly kit.
4. Product: Model # 7300 Modular Long Jump Pit with Flushend option manufactured by ACO Polymer Products, Inc. (Basis of Design).

C. High Jump:

1. Landing pad with Skirted Breather Cover.
    a. Product: Model # IAP-26 manufactured by AAE.(Basis of Design).
    b. Weather Cover
        1) Product: Model # IWC manufactured by AAE. (Basis of Design).
    c. High Jump Standards
        1) Product: Model # MJS manufactured by AAE. (Basis of Design).
    d. High Jump Crossbars
        1) Product: Model # XG4 manufactured by AAE. (Basis of Design).

D. Throwing Form Systems:
1. Nominal 10' x 10' x 6” welded aluminum concrete form.
2. 2" x 2" x 1/4" thick aluminum angle circles
3. Circle diameters:
    a. Discus: 8' 2-1/2"
        1) Product: Model # DFS manufactured by AAE. (Basis of Design).
    b. Shot Put: 7'-0”
        1) Product: Model # SHFS manufactured by AAE. (Basis of Design).
4. Discus Cage: Product: Model # HSDC manufactured by AAE. (Basis of Design).
5. Shot Put Cage: Product: Model # SC-12 manufactured by AAE. (Basis of Design).

E. High School Hurdle:
1. Aluminum Frame
2. Push-button height adjustment modified to 24"/27"/30"/33"/36"
3. Flat base, stabilizer bar and reinforced post welded into 3-way hurdle frame
4. Powder-coated telescoping tubes
5. Self-adjusting weights
6. Double-web Lexan board - standard 41" width
7. Product: Model # XLAH-CP manufactured by AAE. (Basis of Design).

2.10 TENNIS COURT EQUIPMENT

A. Tennis Posts: Classic Round Post, (Green), manufactured by Edwards. (Basis of Design).
1. Product: Tomark Model # TB-K15415.
2. Provide round, 3-inch-diameter steel tubing with an internal brass winder mechanism and removable handle, steel pulley and axle, and net lacing bars.
3. Provide complete with galvanized ground sleeves Model # TB-K15418 and galvanized center anchor Tomark Model # TB-K15412.

B. Tennis Net: Model #30LS manufactured by Edwards. (Basis of Design).
1. Product: Tomark Model # TB-K15428.
2. Provide heavy duty 34 oz. headband sewn with four rows of Dacron thread.
3. The net body 3.5mm braided polyethylene twine.
4. The net is supported by a 5mm PVC-coated aircraft cable with an extra-heavy-duty bottom tape to resist court abrasion. Thick pockets allow side sticks to be inserted.

C. Center Net Strap: manufactured by Edwards. (Basis of Design).
1. Product: Tomark Model # TB-K15409.
2. Polyester tennis net strap with a snap for the center of the net.

D. Windscreen: Premium grade windscreen with reinforcement and vents.
1. Product: Model # WSP7850 as manufactured by Nylon Net, Inc..

2.11 OUTDOOR SCOREBOARDS

A. Baseball/Softball:
1. Size: 18' x 8' x 8” with 24” digital display and wireless controller.
2. Product: Model # 1530 manufactured by Nevco. (Basis of Design).

3. Product: Similar Model manufactured by Daktronics.

B. Football/Soccer/Lacrosse/Track/Field Hockey Stadium:
   1. Size: 24' x 10'-6" x 8" with 24 " digital display, 1/10 of a second timing and wireless controller.
   2. Product: Model # 7525 manufactured by Nevco. (Basis of Design).

PART 3 EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where equipment and systems are to be installed and notify the contractor of conditions detrimental to the proper and timely installation and completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable and to the satisfaction of the Architect/Engineer or Owner's Representative.

3.02 INSTALLATION

A. All athletic equipment shall be installed as indicated on approved submittals as recommended and in strict accordance with manufacturer's written directions and as indicated on the drawings and specified herein.

B. All concrete footings for athletic equipment shall be installed as indicated on the drawings and in accordance with Section 03 30 00, Cast-in-Place Concrete.

C. All sleeves required for athletic equipment installation shall be set plumb and true to line and grade in concrete as indicated on the drawings and per manufacturer's recommendation.

D. All athletic equipment shall be installed in strict accordance with the latest rules, regulations and specifications governing that sport or event for which it is being installed.

3.03 TESTING, ADJUSTMENT AND OPERATION

A. All athletic equipment requiring testing, adjustments and operation shall be tested for proper operation and adjusted to conform to specified standards.

B. Provide certifications as required, indicating that equipment has been tested and adjusted to conform to specified standards.

C. Provide operating and maintenance instructions and manuals to Owner -designated personnel for the proper operation and care of equipment after equipment has been tested and adjusted to conform to specified standards.

3.04 CLEANING

A. Upon completion of work in any given area, remove all trash and debris from the work area and leave in clean condition.

END OF SECTION -

SECTION 11 68 33

STADIUM PADDING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to furnish and install the athletic equipment, as indicated on the drawings and as specified herein. Athletic equipment shall include, but not be limited to:

1. BaseZone® Stadium Padding

1.02 RELATED WORK

A. Examine contract documents for requirements that affect work of this section. Other specification sections that directly relate to the work of this section include, but are not limited to:

1. 32 18 13 – Athletic and Recreational Surfacing
2. 03 10 00 – Concrete Forming and Accessories
3. 03 20 23 – Concrete Reinforcing
4. 32 31 00 – Fences and Gates

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. National Federation of State High School Associations (NFHS)
2. National Collegiate Athletic Association (NCAA)
3. International Amateur Athletic Association (IAAF)
4. American Sports Builders Association (ASBA)
5. American Wood Preserver's Association (AWPA)
6. Manufacturers Data and Recommended Installation Requirements

1.04 SUBMITTALS

A. Manufacturers Product Data

1. Provide manufacturers product data prior to actual field installation work, for Architects or Owners representatives review.

B. Shop Drawings

1. Provide drawings of the manufacturers recommended installation and foundation requirements prior to actual field installation work, for Architects or Owners representatives review.

1.05 QUALITY ASSURANCE

A. Manufacturers warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.

1.06 PRODUCT DELIVERY AND STORAGE

A. Materials delivered to the site shall be examined for damage or defects in shipping. Any defects shall be noted and reported to the Owners representative. Replacements, if necessary, shall be immediately re-ordered, so as to minimize any conflict with the construction schedule. Sound materials shall be stored above ground under protective cover or indoors so as to provide proper protection.

PART 2 PRODUCTS

2.01 BaseZone® Stadium Padding

A. BASE: BaseZone® Stadium Padding as manufactured by:

Promats Athletics, LLC.
P.O. Box 2489
Salisbury, NC 28145
P: 800-617-7125
F: 704-637-2145
http://www.promatsathletics.com/

B. COMPONENTS:

1. 3” High Impact Polyurethane Foam
2. 5/8” Water Resistant Composite Wood Panel, Painted, Primed, and Sealed on all sides.
3. 18 oz. High UV Vinyl, 5 year Limited Fade Warranty
4. Stainless Steel Staples, T-Nuts, Bolts
5. 1 Year Limited Warranty

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

A. All athletic equipment shall be installed as recommended with manufacturer's written directions, and as indicated on the drawings.

Qualifications; three installs in three years.

END OF SECTION

SECTION 12 24 13

WINDOW TREATMENT – ROLLER SHADES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Manual roller shades with light filtering fabric for exterior clear glazed windows and interior vision panels, doors and sidelights as scheduled.

C. Provide multi-band operation of two or more shades with a single operator.

1.02 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

B. NFPA 701 - Fire Tests for Flame-Resistant Textiles and Films.

1.03 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Product data: Provide manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   3. Storage and handling requirements and recommendations.
   4. Mounting details and installation methods.

C. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

D. Samples for Initial Selection: For each colored component of each type of roller shade indicated.

E. Window Treatment Schedule: Submit Window Treatment Schedule using same room designations indicated on Drawings.

F. Maintenance Data: Include in maintenance manuals:
   1. Methods for maintaining roller shades/blinds and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
   3. Operating hardware.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has successfully completed and serviced installations similar in scope to that indicated for this Project.

B. Source Limitations: Obtain each type of window treatment through one source from a single manufacturer.

C. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

D. Fire-Test-Response Characteristics: Provide window treatment materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Resistance Ratings: Passes NFPA 701.

E. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories.
   1. Locate mock-up in window designated by Architect.
   2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in window treatment schedule.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install window treatment until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.07 WARRANTY

A. Products: Minimum 10 years from substantial completion or manufacturer's standard warranty.

B. Installation: One year from substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturer: This Specification is based on products as indicated under individual product descriptions.

2.02 MANUAL ROLLER SHADES

A. Basis of specification
   1. For base bid:
      a. MechoShade: MechoShade/5 with ThermoVeil 1000 Series.
      b. Subject to compliance with requirements, the following additional manufacturers are also approved:
         1) Draper Shade & Screen Co., Inc.; Manual FlexShade XD with Phifer 4400 3% open or similar.
   2. Color: One standard color as selected by Architect from manufacturer's standard
   3. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of

diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Provide capacity for one roller shade band per roller.

4. Direction of Roll: Regular, from back of roller.
5. Mounting Brackets: Mecho/5 Extended Bracket. Sizes to be compatible with window /shade size and clutch capacity. Bracket style to be compatible with mounting requirements and site conditions.
6. Bottom Bar: Steel or extruded aluminum. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
7. Shade Operation: Manual - with continuous loop bead chain, clutch, and cord tensioner and bracket lift operator.
8. Position of Clutch Operator: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated or dictated by field conditions.
9. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
10. Lift Assist Mechanism: Manufacturer's standard spring assist for balancing roller shade weight and lifting heavy roller shades.
11. Bead Chain: Nickel-plated metal or Stainless steel.
12. Cord Tensioner Mounting: As required per installation.
13. Operating Function: Stop and hold shade at any position in ascending or descending travel.
14. Fascia: SnapLoc Fascia.
15. Shade cloth: Provide the following as shown and scheduled:
    a. WT-1: ThermoVeil Dense Vertical Weave, 1000 Series (2-3% open)
    b. WT-2: Equinox Blackout, 0100 Series (opaque)

B. ROLLER SHADE FABRICATION

1. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
2. Concealed Components: Non-corrodible or corrosion-resistant-coated materials.
    a. Lifting Mechanism: With permanently lubricated moving parts.
3. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
    a. Shade Units installed outside (typical) : If inside mount is required, edge of shade not exceed 1/4 inch from face of jamb.
    b. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
    c. Fabricate shadecloth to hang flat without buckling or distortion.
4. Installation Brackets: Shall allow for easy removal and reinstallation of shade, operating hardware and for hardware position and shade mounting method indicated.
5. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal non-corrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
6. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER SHADE INSTALLATION AND ADJUSTING

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Install roller shades for multi-band operation in locations shown.
   1. Provide Lift-Assist Mechanism at multi-band shades over 8 pounds, or as required by manufacturer.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.03 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Remove surplus materials, rubbish, and debris resulting from installation upon completion of work, and leave areas of installation in neat, clean condition.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensure that roller shades are without damage or deterioration at time of Substantial Completion.

3.04 SCHEDULE

A. Provide roller shades at the locations shown on the Drawings.

END OF SECTION

SECTION 12 34 00

LAMINATE CLAD CASEWORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Fixed modular laminate clad casework and components.

1.02 RELATED SECTIONS

A. Section 06 10 00: Blocking within walls where indicated.

B. Division 9: Base molding.

C. Section 12 36 00: Countertops

1.03 DEFINITIONS

A. Identification of casework components and related products by surface visibility.
   1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
   2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.
   3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
   4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
   5. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
   6. Concealed Surfaces: Any surface not visible after installation.

1.04 QUALITY ASSURANCE

A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.

1.05 SUBMITTALS

A. Comply with Section 01 30 00, unless otherwise indicated.

B. Product Data: Manufacturer's catalog with specifications and construction details.

C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
   1. Include section drawings of typical and special casework, work surfaces and accessories.
   2. Indicate locations of plumbing and electrical service field connection by others.

D. Component samples: Two sets of samples for each of the following:
   1. Decorative laminate color charts.

2. PVC edgings.

1.06 PRODUCT HANDLING

A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed, store in ventilated place, protected from the weather, with relative humidity range of 25 percent to 55 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

1.07 JOB CONDITIONS

A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.
   1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
   2. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.

B. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete.

1.08 WARRANTY

A. All materials and workmanship covered by this section will carry a five (5) year warranty from date of acceptance.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Approved Manufacturers:
   1. Basis of specification: TMI Systems Design Corporation.
   2. LSI
   3. Case Systems

B. Substitution: See Section 01 60 00 . Other manufacturers shall comply with the minimum levels of material and detailing indicated on the drawings or as specified.
   1. Subject to compliance with the specifications, the following manufacturers are approved:
      a. Stevens Industries, Inc.
      b. Mastercraft, Inc.

2.02 MATERIALS

A. BASE BID : Core Materials:
   1. Certified Particleboard: SCS Certified 100% pre-consumer recycled wood fiber particleboard with no Urea Formaldehyde added during the manufacturing process.
      a. Up to 7/8 inch thick: Industrial Grade average 47-pound density meeting ANSI A 208.1-1999, M-3 requirements.
      b. 1 inch think: Industrial Grade average 45-pound density meeting ANSI A 208.1-1999, M-2 requirements.
      c. MR Moisture Resistant Particleboard: Average 47-pound density particleboard, ANSI A208.1 1-1999, M-3.
   2. Medium Density Fiberboard 1/4 inch thick: Average 54-pound density grade, ANSI A208.2.

B. Decorative Laminates: GREENGAURD Indoor Air Quality Certified
   1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.

2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.
3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.
4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.
5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.
6. Thermally fused melamine laminate, NEMA Test LD 3-2005, color matched with White.

C. Laminate Color Selection: Maximum 1 color per unit face and 4 colors per project. (See Color Selection in section 3.06).

D. Edging Materials:
1. 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius.

2.03 CABINET HARDWARE

A. Hinges:
1. Five knuckle, epoxy powder coated, institutional grade, 2-3/4 inch overlay type with hospital tip. 0.095 inch thick. ANSI-BHMA standard A156.9, Grade 1.
   a. Doors 48 inches and over in height have 3 hinges per door.
   b. Magnetic door catch with maximum 5 pound pull provided, attached with screws and slotted for adjustment.

B. Pulls:
1. Door and drawer front pulls are rectangular, semi-recessed, injection molded plastic, screw fastened. Pull design shall comply with the Americans with Disability Act (ADA).

C. Drawer Slides:
1. Full extension: 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

D. Adjustable Shelf Supports:
1. Injection molded transparent polycarbonate shelf supports friction fit into cabinet end panels and vertical dividers, adjustable. Shelf support have minimum 2 integral support pins to interface pre-drilled holes, and to prevent accidental rotation of support. The support shall adapt to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

E. Locks:
1. Removable core, disc tumbler, cam style lock with strike. Lock for sliding 3/4 inch thick doors is a disc type plunger lock, sliding door type with strike.
2. Elbow catch or chain bolt used to secure inactive door on all locked cabinets.

2.04 FABRICATION:

A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.

B. All casework panel components sized/cured to be precisely finished in size and squareness to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.

C. Cabinet Body Construction:
1. Tops and bottoms shall be glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals.
   a. Tops, bottoms and sides of all cabinets are particleboard core.

b. Tops, bottoms and sides of sink base units are moisture resistant particleboard core.

2. Cabinet backs: 1/4 inch thick medium density fiberboard panel fully captured by the cabinet top, bottom and side panels. Finish to match cabinet interior. 3/4 inch x 4 inch particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength.
3. Fixed base and tall cabinets shall have factory mounted bases of 3/4 inch thick exterior grade plywood. Base is nominal 4 inch high unless otherwise indicated on the drawings.
4. Base units, except sink base units: Full sub-top. Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.
5. Side panels and vertical dividers shall receive adjustable shelf hardware. Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.
6. Exposed and semi exposed edges.
   a. Edging: 1mm PVC.
7. Adjustable shelf core: 3/4 inch thick particleboard up to 36 inches wide, 1 inch thick particleboard over 36 inches wide.
   a. Front edge: 1mm PVC.
8. Interior finish, units with open Interiors:
   a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with VGS high-pressure decorative laminate.
9. Interior finish, units with closed Interiors:
   a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with thermally fused melamine laminate.
10. Exposed ends:
    a. Faced with VGS high-pressure decorative laminate.
11. Wall unit bottom:
    a. Faced with thermally fused melamine laminate.
12. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), are not permitted.

D. Drawers:
1. Sides, back and sub front: Minimum 1/2 inch thick particleboard, laminated with thermally fused melamine doweled and glued into sides. Top edge banded with 3mm PVC.
2. Drawer bottom: Minimum 1/2 inch thick particleboard laminated with thermally fused melamine, screwed directly to the bottom edges of drawer box.
3. Paper storage drawers: Minimum 3/4 inch thick particleboard sides, back, and sub front laminated with thermally fused melamine. Minimum 1/2 inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

E. Door/Drawer Fronts:
1. Core: 3/4 inch thick particleboard except at sink units which is 3/4 inch thick moisture resistant particleboard.
2. Provide double doors in opening in excess of 24 inches wide.
3. Faces:
   a. Exterior: VGS High-pressure decorative laminate.
   b. Interior: High-pressure cabinet liner CLS.

4. Door/drawer edges: 1mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

F. Miscellaneous Shelving:
1. Core material: 3/4 inch or 1 inch thick particleboard.
2. Exterior: VGS High-pressure decorative laminate.
3. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

PART 3- EXECUTION

3.01 INSPECTION:

A. The casework contractor must examine the job site and the conditions under which the work under this section is to be performed, and notify the building owner in writing of unsatisfactory conditions. Do not proceed with work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION:

A. Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.03 KEYING:

A. Key alike by room, unless otherwise instructed.

B. Provide locks for each cabinet.

3.04 INSTALLATION:

A. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut for accurate fit.

B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.
1. Install drawer pulls horizontally.
2. Install door pulls vertically.

C. Repair minor damage per plastic laminate manufacturer’s recommendations.

D. Install countertop and backsplash.
1. Scribe and cut for accurate fit to wall and under window stools.
2. Coordinate openings with grilles supplied in Section 06200.
3. Provide 1 inch overhang at countertop over lockers.

3.05 CLEANING:

A. Remove and dispose of all packing materials and related construction debris.

B. Clean cabinets inside and out. Wipe off fingerprints, pencil marks, and surface soil etc., in preparation for final cleaning by the building owner.

3.06 COLOR SELECTION:

A. Laminate Color Selection: From Formica, Nevamar and Chem Metal stock colors.

B. Hinge and Pull Color Selection: From manufacturer's standard

C. Miscellaneous Hardware Color Selection (support brackets, table frames, rail): From manufacturer's standard.

D. 1mm PVC Edge Banding Color Selection: From manufacturer's standard of colors matching decorative laminate.

E. 3mm PVC Edge Banding Color Selection: Match decorative laminate color selection.

END OF SECTION

SECTION 12 36 00

COUNTERTOPS AND BACKSPLASHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Countertops for manufactured casework.

C. Wall-hung counters.

1.02 RELATED REQUIREMENTS

A. Section 1140 00 - Foodservice Equipment: Stainless steel work coounters and window stools.

1.03 REFERENCE STANDARDS

A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.

B. ANSI A208.1 - American National Standard for Particleboard; 2009.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

E. PS 1 - Structural Plywood; 2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. LEED Report: Submit for wood products made from sustainably harvested wood, salvaged and reused wood, wood fabricated from recovered timber, and locally-sourced wood, as specified in Section 01 35 15.

H. Installation Instructions: Manufacturer's installation instructions and recommendations.

I. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

B. Installer Qualifications: Fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOP ASSEMBLIES

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.

B. Plastic Laminate Countertops: High pressure decorative laminate sheet bonded to substrate.
   1. Laminate Sheet, Unless Otherwise Indicated: NEMA LD 3 Grade HGS, 0.048 inch nominal thickness.
      a. Finish: Matte or suede, gloss rating of 5 to 20.
      b. Surface Color and Pattern: As scheduled.
      c. Manufacturers:
         1) Formica Corporation: www.formica.com.
         2) Panolam Industries International, Inc\Nevamar: www.nevamar.com.
         3) Panolam Industries International, Inc\Pionite: www.pionitelaminates.com.
         4) Wilsonart International, Inc: www.wilsonart.com.
         5) Substitutions: See Section 01 60 00 - Product Requirements.
   2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
   3. Back and End Splashes: Same material, same construction.

2.02 ACCESSORY MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.
   2. Provide sustainably harvested wood, certified or labeled as specified in Section 01 60 00.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.

D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of

materials being joined.

E. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.02 CLEANING

A. Clean countertops surfaces thoroughly.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Benches
   2. Picnic Tables
   3. Trash and Litter Receptacles
   4. Recycling Receptacles
   5. Bicycle Racks
   6. Flagpoles
   7. Trail Bollards
   8. Bollard and Chain Barriers
   9. Pond Aerators
   10. Floating Pond Fountains and Lights

B. Related Sections:
   1. Division 3 Section " Cast in Place Concrete"
   2. Division 26 Section "Exterior Electrical"

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including assembly and installation instructions.

B. Samples for Color Verification: For units with factory-applied color finishes (bench, picnic tables, trash and recycling receptacles, bicycle racks, trail bollards and bollard and chain barrier).

C. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

D. Maintenance Data: For site furnishings to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Obtain site furnishings from specified sources.

B. Installer qualifications:
   1. Site furniture to be installed by manufacturer's Certified Installer whose work has resulted in construction of at least five similar installations, with a record of successful in-service performance for at least three years.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect all site furniture during storage and construction against rain, snow or ground water, and against soiling or contamination from earth and other materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Contractor to verify quantity on plans.

B. Bench:
   1. Landscapeforms, Kalamazoo, MI, contact Barbara Nolan Inc, Tracey Friedly 410-951-9090
   2. Model: Scarborough
   3. Backed horizontal strap with one intermediate arm rest
   4. Length – 8’-0”
   5. Surface mount.
   6. Color: Titanium powdercoat.

C. Trash Receptacles:
   1. Quantity: 24
   2. Landscapeforms, Kalamazoo, MI
   3. Scarborough Series, Side-opening style with vertical strap side panels
   4. Surface Mount
   5. Color: Titanium powdercoat.

D. Recycling Receptacles:
   1. Quantity: 12
   2. Landscapeforms, Kalamazoo, MI
   3. Scaroborough Series, Side-opening style, single use recycling opening
   4. Signage by mfr. – Type 09 (Bottles/Cans)
   5. Surface Mount
   6. Color: Titanium powdercoat.

E. Bicycle Rack
   1. Creative Pipe Inc., 1-800-644-8467
   2. Inverted ‘U’ Bike Rack
   3. Model: SU-20EP, embedded mount, capacity 2 bikes.
   4. Color: Metallic Silver

F. Concession Area Picnic Tables
   1. DuMor Site Furnishings, 1-800-598-4018
   2. Model: 156 Series PL, surface mount
   3. Color: Mill Finish Aluminum

G. Flagpoles
1. Flagpole Warehouse, 1-800-962-0956
2. Architectural Series Internal Halyard flagpoles
3. Model: EC30IH, 33’-0” overall height (30’-0” exposed height) – qty.: 4
4. Model: EC40IH, 44’-” overall height (40’-0” exposed height) – qty.: 2
5. Aluminum, satin finish

H. Trail Bollards
1. Fairweather Site Furnishings, 1-800-323-1798
2. Model: B-1 Bollard, 6” dia., 42” ht., removable mounting
3. Color: Black gloss

I. Bollard and Chain Barrier
1. Fairweather Site Furnishings, 1-800-323-1798
2. Model: B-1 Bollard, 8” dia., 36” ht. with eyelets and chains.
3. Separate top for concrete fill
4. Color: Black gloss

J. Pond Aerators – Vertex Water Features, 1-800-432-4302
a. Pond #1
1) Model: Vertex High Flow Air 3 Plus for shallow water with Sound Kit for medium cabinet, (4) CoActive Air Stations
b. Pond #2
1) Model: Vertex High Flow Air 2 Plus for shallow water with Sound Kit for medium cabinet, (2) CoActive Air Stations

K. Floating Pond Fountains – Vertex Water Features, 1-800-432-4302
a. Pond #1
1) Model: Vertex Funnel Jet Fountain (10HP/45’ dia. display) with Light Package
b. Pond #2
1) Model: Vertex Funnel Jet Fountain (2HP/25’ dia. display) with Light Package

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install site furnishings as per manufacturer’s recommendations and details shown in these documents. Provide electrical service where required per manufacturer’s specifications.

B. Do not install any materials with chips, cracks, discolorations and other defects that would cause visible discoloration on the finished work.

C. Stake out all locations of site furniture for approval Architect prior to installation and anchoring.

D. Site furnishings as appropriately noted shall be permanently anchored as required by the drawings and manufacturer's recommendations.

E. Install all products plumb and level.

F. Install footings as per specifications and as required by manufacturer's specs, structural drawings and specifications.

END OF SECTION 129300

SECTION 13 34 16

GRANDSTANDS AND BLEACHERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide outdoor permanent grandstands as described and shown on drawings and detailed in these performance specifications.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete Foundations.

B. Division 26 - Electrical: Main electrical feed and final hook-up to press box.

C. Division 31 - Earthwork: Surveying and site preparation.

D. Division 32 - Exterior Improvements: Landscape fabric and stone base under grandstands.

1.03 DESIGN REQUIREMENTS

A. New bleacher designs have been developed per recommendations by the district and no design changes are allowed. Contractor must verify that listed manufacturers are bidding on an equal basis as no design alterations or changes will be allowed for the bleachers or press boxes.

B. Bleachers include:
   1. Base Bid- Seats (Per Plans)
      a. 2,681 seats with a 42' wide steel framed sloped front two-tier press box and permanent steel canopy cover.
      b. 1,353 visitor side stand with filming platform
   2. Alternate Bid-
      a. 3,417 seats with a 42' wide steel framed sloped front two-tier press box and permanent steel canopy cover.
      b. 1,641 visitor side stand with filming platform
   3. Soccer bleachers approx 817 seats
   4. Mitered Baseball bleachers with press box approx. 618 seats
   5. Mitered Softball bleachers with filming platform approx 506 seats

C. Provide necessary demolition, engineering, material, freight, concrete, installation, related site work and supervision to provide grandstand seating systems listed below in accordance with the following performance specifications.

D. The minimum acceptable standards of design are:
   1. Grandstands are elevated per plans. Front Walkway to be 6'-2" deep. Center walkway on Baseball/Softball per plans. Overall length per plans, Total net seating capacity with Handicap seating per plans.
   2. The riser height tread depth and decking type is noted on each layout.
   3. Aisle layout is per plans. There shall be center aisle rails or end aisle rails per code.
   4. Handicap seating areas per plans with necessary closure panels.
   5. Finishes to be "hot dipped" galvanized on the steel understructure, clear anodized on the seat boards, High Performance Dur-Kyn paint on the aluminum aisle nosing strips at aisles and stairs, High Performance Dur-Kyn painted finish on aluminum stair risers and main grandstand risers. Perimeter Railing risers to be hot dipped galvanized, rails to be clear anodized and utilizes 6 ga. black vinyl chain link fencing.

6. Walking Surfaces - All walking surfaces shall be manufactured and extruded in a manner that provides for spectator safety in wet conditions. Walking surface traction (slip coefficient) shall be classified as High Traction as defined by ANSI B101.1. Surfaces shall be extruded with repetitive serrations of ridges and valleys. Walking surface shall be shop blasted to achieve the high traction certified rating. To prevent unwanted surface stains caused during the manufacturing, shipping and installation process, surface shall have a clear anodized finished. This entire process with the anodizing must meet the walking surface traction requirements of the ANSI and ADA codes. Mill finish products are not acceptable and do not meet this specification. Tribometer testing is no longer an approved testing method of ASTM and therefore not acceptable
7. The front and side closures where noted will be Dur-Kyn Ptd. Aluminum riser panels to provide closure from the walkway elevation to approx. 3" above grade. This closure is along the front of the bleacher and also around the front and sides of all front exits and side ramps per plans.
8. Signage
   a. Properly label all handicap seating areas
   b. Provide press box signage- All press boxes- Signage to be determined
9. Foundations have been designed for this project. Final approval drawings should provide a sealed set of documents inclusive of these designs
10. Football Press Box: 42' wide steel framed, sloped front two-tier press box with exterior rear stair to filming platform and steel roof mitered canopy.
11. Baseball Press Box: steel framed sloped front design per plans.
12. Seat Planks are anodized aluminum plank.
13. Inspections/ Certificates - Submit with Bid:
    a. AISC plant certification of manufacturer required prior to bid. Submit with bid documents.
    b. National floor safety institute or approved equal documentation for extra traffic coating as specified meeting high traction per ANSI B101.1
    c. Press boxes shall include ICC certified inspections for construction of electrical work. Data plate, certified sticker and back up documentation required.

1.04 QUALITY ASSURANCE

A. Manufacturers Qualifications:
   1. Manufacturers must have a minimum of ten years of experience in the manufacturing of grandstands and press boxes under current company name as a sole source provider.
   2. Manufacturer must provide five references (if requested) of similar projects within a reasonable driving distance from the project site completed in the last three years for visual inspection. References shall include scope of work, contract amount, owner's name and phone numbers, contract completion date and actual completion date.
   3. Manufacturer shall have local representation within a reasonable mile radius of the project. Representative is responsible to attend job site meetings, provide sequencing and scheduling information and make decisions on behalf of the manufacturer. Due to the coordination and timeframe of this project, it is imperative that this representative can immediately respond, in person, to evaluate questions, concerns and actions and resolve issues that immediately impact the fabrication and installation of the product or other contractors' abilities to proceed with their work. Resume of representatives needs to be submitted for review and approval.
   4. List with submission the date that you visited the site and reviewed the existing conditions.

5. If approved bidder is a dealer or representative of the manufacturer in addition to the manufacturer the dealer must provide the same information required in this section.
6. Welders must be AWS certified; manufacturing capabilities in accordance with the governmental agencies having jurisdiction.

B. Installers Qualifications:
1. Factory-trained and experienced in the installation of grandstands.
2. Project is a prevailing wage job. Certified payrolls are required on this project.

C. Source Quality Control: Mill Test Certification.

D. Single Source Responsibility: Obtain all of each distinct material required from a single manufacturer.

E. Code Compliance: Provide aluminum bleachers to meet or exceed all State and Local applicable codes and in compliance with the IBC/ICC National Code and CABO/ANSI A117.1 Barrier Free Subcode, Current Editions.

1.05 SUBMITTALS

A. Product Data: Submit technical data for each distinct type of material, component and accessory indicated.
1. Include information which specifically details physical properties and performance characteristics.

B. Shop Drawings: Manufacturer to submit shop drawings and structural design calculations signed and sealed by a Delaware licensed Professional engineer, and schedules for type, location, quantity and details of all aluminum components required for this project.
1. Indicate on shop drawings that products are in compliance with IBC/ICC National Building Code and all other State and Local Codes and Regulations.
2. Concrete designed per American Concrete Institute Guidelines

C. Samples: Submit manufacturer's samples for aluminum components, and an 18 inch seat sample.

D. Certificate: Submit manufacturer's certification that materials furnished comply with requirements indicated and also in compliance with the IBC/ICC code and all other applicable Federal, State and local codes, and that materials meet or exceed test requirements indicated.

1.06 WARRANTY

A. Submit a written warranty signed by the manufacturer, installer, and the contractor, guaranteeing to correct failures for a period of two (2) years after substantial completion, without reducing or otherwise limiting any other rights to correction which owner may have under the contract documents. Failures are defined to include faulty workmanship or faulty materials. Correction may include repair or replacement.

1.07 BUILDING CODES

A. Comply with all applicable codes, which include but are not limited to the following:
1. IBC/ICC Building Code- Current Edition
2. AISC Manual of Steel Construction, 9th Edition
3. Aluminum Association of America Guidelines
4. IBC barrier free sub-code and Guidelines
5. U.S. Department of Justice ADA Standards
6. American Concrete Institute

B. The bleacher shall be designed to support, in addition to its own weight, a uniformly distributed live load of not less than 100 pounds per square foot of gross horizontal projection of the bleacher.
   1. Add 6 pounds per square foot of dead load on seats, footboards, risers and steel framing.

C. All seat and footboard members shall be designed to support not less than 120 pounds per linear foot. The bleacher shall be designed to resist, with or without live load, horizontal wind load appropriate for local conditions. It shall also be designed to resist, in addition to the live load, sway forces applied to the seats in a direction parallel to the length of the seat planks 24 pounds per liner foot; and, in a direction perpendicular, stresses in aluminum members and connections shall not exceed those specified for Building Type Structures by the Aluminum Association.

D. General: The structure shall be properly braced for wind and construction loads until all structural elements are secured. Lateral and longitudinal bays shall be cross-braced as required. Guardrails shall be of adequate size, location, and height to meet specified codes and designed to carry required loads. Exit stairs and intermediate aisle stairs shall be completely closed, in the direction of travel and shall have a maximum rise of 7 inches and a minimum tread of 11 inches.

E. Code Compliance: Submittals shall be based upon specifications and drawings contained in the bid documents. Architect will not review any design or product changes prior to the bid date. Design changes to reduce overall aisle egress calculations or number of stair and ramp exits will not be allowed. Design changes to seatboard bracket support and location is not allowed. All bidders must bid in accordance with these specifications.
   1. The Bleacher Contractor shall be responsible to meet the code interpretation provided in the bid documents and modify as required by state or local governmental review boards.
   2. Calculations that demonstrate code compliance with egress and exit of aisles, stairs, and ramps are a required submission with approved drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design:
   1. Southern Bleacher Company, 801 Fifth St., P.O. Box One, Graham, Texas 76450, (800) 433-0912.

B. Products specified herein have been selected because of their quality of construction, configuration, design, function, available finishes, components, accessories, dimensions, shape and style.

C. Other manufacturers include:
   1. Dant Clayton Corporation, 1500 Bernheim Lane, Louisville, KY 40210 (502) 634-3626.
   2. Outdoor Aluminum Inc., P.O. Box 118, Geneva, AL 36340, (800) 225-4249.

D. All manufacturers shall submit the following information to verify compliance and financial responsiblity for meeting the intent of these performance specifications.
   1. Provide a side by side comparison of all products specified including the press box per these performance specifications
   2. Provide documentation certifying that the all walking surfaces meet the criteria set forth in the specifications
   3. Provide proof of a minimum of 10 years manufacturing experience.

4. Provide a reference list with contacts for a minimum of 5 projects within a reasonable driving distance from the project site over the last 3 years. This list should be of similar projects.
5. Provide a sample drawing of press box to verify compliance with specified box.
6. Provide proof of participation and certification listed in 1.1.13

E. Sole source manufacturing: All products within this specification shall be manufactured by a sole source facility.

F. Architect/Engineer/Owner reserves the right to accept or reject Grandstand manufacturers. All approvals will be in writing through addendum prior to the bid date.

2.02 PERMANENT STEEL GRANDSTAND

A. Interlocking Deck- Home and Visitor Football Grandstands; Semi-Closed Aluminum Decking for Soccer Stand and Fully Closed Tongue and Groove Decking for Baseball and Softball Grandstands.

B. All as shown and noted on plans.
1. The intent of the product design is to reduce deflection of aluminum deck and to eliminate fluid drainage below spectator seating.
2. All individual deck members shall be locked together longitudinally at all treads, front walk and cross walk locations.
3. This design, in ambient conditions, allows for expansion and contraction without damage or deformation of the aluminum deck.
4. The locking design does not allow any fluids to pass to the ground under the spectator seating.
5. Extrusion gutters are part of each decking member that will allow for the collection and control of fluids that occur on the deck surface.
6. At all butt joint locations, internal gutters shall be mounted onto the structural members to direct fluids to determined locations.
7. Vertical columns are to be placed 6 feet 0 inches on center laterally and front to back per plans.
8. Traverse bays are free of cross bracing the total length of the grandstand.
9. Stringers are wide flange with steel angle rise and depth fabrication and are placed 6 feet on center.

C. Front Walkway:
1. All grandstands to be elevated per plans.

D. Entry stairs:
1. Firmly anchored to uniformly poured concrete bases.
2. Stair rise: 7 inches max. per IBC Building Code with aluminum closure.
3. Stair tread depth: 11 inches min. per IBC Building Code.
4. Guardrails on Stair to be 42 inches above leading edge of step with intermediate rails.
5. Stairs to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corner. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the nosing of treads and landings. Handrails shall be continuous the full length of the stairs and shall extend in the direction of the stair run not less than 12 inches beyond the bottom riser. Ends shall be returned or shall terminate in newel posts or safety terminals.

E. Aisles:
   1. Aisles with seating on both sides to have 34-inch high handrail with intermediate rail at approximately 22 inches above tread.
   2. Anodized aluminum handrails with rounded ends (no fittings) are discontinuous to allow access to seating through a space 22 inches (min.) to 36 inches (max.).
   3. Intermediate steps shall provide equal rise and run throughout aisle. Each shall have aisle nosing with Dur-Kyn finish and riser closure with Dur-Kyn finish.

F. Interlock Deck System-
   1. Rise and depth at each row is per plans
   2. Each seat 17 inches above its respective tread.
   3. Decking Arrangement:
      a. The seats shall be 2”x10” seat plank with two internal legs and extruded aluminum alloy, 6063-T6 with clear anodized 204R1, AA-M10C22A31, Class II finish. Mounting brackets to be “L” type riser mounted.
      b. The tread system shall be comprised of uniform serrated, slip resistant aluminum extrusions which interlock together lengthwise and form a .922” x .60” V-shaped gutter running the length of the planks. The interlocking mechanism will minimize deflection and not separate due to loads being applied to individual planks. The locking mechanism by design shall allow for expansion and contraction of individual planks without effecting performance of the system.
      c. The system shall cause the deck planks to react together at all treads and cross walks to live load and form the appearance of a single tread system. By design, this system forms a solid, overlapping tread and riser installation.
      d. The nose extrusion shall allow for a 1” extruded aluminum contrasting nose piece to be flush mounted on the leading edge and shall capture the vertical riser plank in an extruded pocket. The heel extrusion shall have a .70” vertical lip at the rear of the plank to allow for placement of vertical riser plank and inhibit fluids from escaping at the rear of the tread.
      e. These extrusions shall be such that the attachment of the seat brackets, step brackets, mid-aisle rails and all other components is accomplished without deck penetrations. No through-bolting or drilling of the aluminum tread / riser system shall be permitted.
      f. The system shall allow for seat and aisle reconfiguration at any time without evidence of its previous configuration.
      g. At all butt joint locations of the interlocking deck system, a secondary gutter shall be installed below the aluminum tread / riser system that allows fluids to be contained and gravity flow toward the first tread. This gutter will collect fluids and control them to specific areas.
      h. The secondary gutter system shall be placed on to the structural steel support system of the grandstand such that the gutter is supported by stringers (raker beams) at each side. These stringers (raker beams) shall be a minimum 12” apart to allow for adequate gutter widths to properly collect fluids drainage.
      i. These secondary gutters shall terminate at strategic locations dependent on the grandstand layout. At the termination points, a collection box will be provided such that the owner can make a connection to allow for desired fluid routing. The intention is to control a majority of the water from collection at the front or under the stand.
      j. Entry stairs and ramps to be 2 x 12 mill finish aluminum.
      k. Open ends of planks to be covered with aluminum end caps, securely fastened to the plank.

l. Joint sleeves: Dual joint sleeves to be inserted at each butt joint of each load bearing aluminum plank, and to penetrate 6 inches into each plank at the joint. Joint sleeves are not required at secondary gutter locations.

G. Guardrailing:
1. To be at sides and front of bleacher. Also provide railing along front and sides of accessible areas per plans.
2. Railing to be anodized aluminum with end plugs at ends of straight runs and/or elbows at corner.
3. All guardrails shall be secured to angle rail risers by galvanized fasteners.
4. Railing shall be 42" above walkways and entrances.
5. Railing shall be 42" above any adjacent seat.
6. Guardrailing on sides, front and rear of stand to be 6 ga. black vinyl fence fabric closure design per plans and details providing a separate top rail.

H. Ramps:
1. Slope: maximum 1:12 using aluminum tongue and groove deck planks
2. Guardrail to be 42 inches above ramp with black vinyl coated chain link rail system and 2 x 6 toeboard.
3. Handrail: Ramps to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the ramp surface. Handrails shall be continuous the full length of the ramp and shall extend in the direction of the ramp not less than 12 inches beyond the end of the ramp. Ends shall be returned or shall terminate in newel posts or safety terminals.
4. All ramp footboards will run perpendicular to the direction of travel, to ensure proper function of anti-skid flutes. Running plank parallel is strictly prohibited.

I. Handicap provision:
1. Quantity of wheelchair spaces: Per Plans.
2. Sides and front of accessible forward pockets to be closed. Sides to have galvanized steel plate factory applied and front closure to be a series of Kynar painted riserboards. Adequate to provide complete closure.
3. Floor mounted companion benches to be provided where necessary

J. Materials/Finishes
1. Substructures:
   a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572, grade 50, A529-50, or A500 grade B.
   b. Shop connections are seal welds.
   c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.
2. Extruded Aluminum:
   a. Seat Planks and Railing are extruded aluminum alloy, 6063-T6 with clear anodized 204R1 coating.
   b. Riser board planks and closure planks are extruded aluminum alloy, 6063-T6, Dur-Kyn painted finish.
   c. Tread planks are extruded aluminum alloy 6063-T6 mill finish

d. Joint Sleeve Assembly to be inserted in flat plank to maintain true alignment in joining together two plank pieces. Extruded aluminum alloy, 6063-T, mill finish. Splice cover is unacceptable between two flat plank pieces joined in a straight line.

K. Accessories:
1. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.
2. Hardware:
   a. Bolts, Nuts: Hot-dipped galvanized or mechanically galvanized.
   b. Hold-down Clip Assembly: Aluminum alloy 6005A-T6, mill finish.
   c. Structural Hardware: Equal to or greater than hot-dipped galvanized ASTM-A307. No connections utilizing high strength bolts are classed as slip critical.
3. Aisle Nose and Stair Nose: Aluminum alloy, 6063-T6, non-skid painted finish. This extrusion shall be recessed into the front floor nosing plank in order to prevent a tripping hazard, no surface mounting will be acceptable.

L. Fabrication:
1. Design Load:
   a. Live Load: 100 psf gross horizontal projection.
   b. Lateral Sway Load: 24 plf seat plank.
   c. Perpendicular Sway Load: 10 plf seat plank.
   d. Live Load of Seat and Tread Planks: 120 plf.
   e. Guardrail: Per IBC/ICC Building Code.
   f. Windload: 30 psf.
2. All manufactured connections to be shop welded.
   a. Manufactured by certified welders conforming to AWS Standards.

2.03 TWO-TIER PRESS BOX WITH STEEL FRAME STRUCTURE

A. Product Description:
1. Type II Construction Design; sloped front design with end viewing glass per plans.
   a. Press Box Dimensions: Base Bid- Two-tier 10'-6" Base, 12'-0" overall depth x 42'-0" long, plus landings for football, with permanent steel framed canopy cover per plans.
   b. Press box Dimensions- Baseball - 8'-0" wide x 18'-0" long, plus landings.
2. Press Box to be of open construction, allowing inspection of electrical wiring, switches and other components without destructive disassembly.
3. Pressbox to be constructed with rear exterior stair to filming platform where shown.

B. Materials/Finishes
1. Press Box Support Structure:
   a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
   b. Shop connections are seal welds.
   c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.
2. Press Box: All materials shall be new and shall comply with ASTM specifications.
   a. Floor
      1) Main support to be a galvanized steel floor frame sized to support structure and metal belly pan for support of insulation.
      2) Floor to be INTERLOCK Aluminum Decking System, extruded aluminum alloy 6063-T6. Attach Decking System to steel floor frame with

mechanical fasteners at end of plank and at intermediate supports.

3) Walking surface traction (slip coefficient) shall be classified as "High Traction" as defined by ANSI B101.1 to match grandstand walkway finish.
4) Insulation: Kraft faced fiberglass building insulation R-11, 3 1/2 inches thick. Batt or roll as manufactured by Owens-Corning Fiberglass Corp., or equal.

b. Wall Structure Steel Framing
   1) 4 inch x 4 inch x 11 gauge square tubing with maximum span of 14 feet on front wall and maximum span of 6 feet on back wall and 4 inch x 2 1/2 inch x 14 gauge steel "cees" with maximum spacing of 5 feet for all walls with siding. Spans greater than these require engineered calculations for design.
   2) Insulation: Kraft faced fiberglass building insulation R-11, 3 ½ inches thick. Batt or roll as manufactured by Owens-Corning Fiberglass Corp., or equal.
   3) Interior Finish
      (a) 1/2 inch vinyl coated gypsum panels, Gold Bond vinyl-surfaced Durasan- Santa Fe porcelain.
         (1) Cove Base: Vinyl 4 inches x .080 color to be medium gray.
   4) Exterior Finish
      (a) 26 gauge prefinished R-Panel paneling as manufactured by MBCI, Signature 200 color series, color to be determined.
      (b) Wall panels are attached with #12 TEK screws - 6" O.C. at the top and bottom of the panels. Lap screws are placed at each end of the panels, at the intermediate supports, and at the mid point between supports (TEK #14). All fasteners to be painted same color as exterior paneling.

c. Roof Structure
   1) 4 inch x 4 inch x 11 gauge square tubing with maximum spacing of 6 feet on center and 4 inches x 2 1/2 inches x 14 gauge steel "cees" with maximum spacing of 2 feet on center.
   2) Roof: 1/8 inch fourway steel plate roof, continuous welded seams coated with acrylic metal primer as manufactured by Coronado and 36 mils of acrylink roof coating as manufactured by Isothermal Protective Coatings, or equal. Plate is welded on both sides of rafters with 1-1/2 inch long 1/8 inch fillet welds on 12 inch centers.
   3) Insulation: Kraft faced fiberglass building insulation, R-19 (minimum) 6 inches thick. Batt or roll as manufactured by Owens-Corning Fiberglas Corp., or equal.
   4) Cornice: 26 gauge steel prefinished- color to be determined.
   5) Ceiling: 24 inch x 24 inch x 5/8 inch acoustical ceiling tile architectural revealed edge style wind clips and other components as manufactured by USG, or equal.
   6) Roof to have a steel framed canopy cover at football press box only.

d. Exterior Doors
   1) Full flush steel construction with honeycomb core. 18 gauge skin sheets. Dimensions: 3 feet 0 inches x 6 feet 8 inches. Color: White.
   2) Steel door frame (16 gauge) complete with 1/2 inch threshold and weather-stripping.
   3) Exterior Hardware: Yale 546F Exterior Trim, or equal. Handles shall be lever type that allows operation without tight grasping or twisting of the wrist. All exterior hardware must accommodate District standard Best core keyed lock system.

4) Interior Hardware: Yale 2100 Exit Device, or equal. Handle shall be panic bar that allows for opening without any grasping, twisting or turning.

e. Interior Walls
   1) Framing to be steel galvanized studs (25 gauge) 1 1/4 inch x 3 5/8 inch at maximum 2 feet on center.
   2) Finishes to be consistent with all other interior finishes.

f. Windows
   1) Provide 24” x 56” interior window in each wall.
   2) Frame: Extruded aluminum single hung, vertical sliding unit, thermal break.
   3) Sash: Tilt toward inside for easy cleaning.
   4) Glazing: Clear tempered panes.
   5) Dimensions of each unit: Dependent on compartment size. At interior wall locations or structural support locations the dimension between windows shall be no greater than 6 inches.
   6) Finish: Electrostatically applied acrylic enamel.

g. Work Bench
   1) 18 inch deep clear anodized aluminum countertop with a radius front edge.
   2) Support using 4” x 2” x 14 ga. Steel “cee” on 4” x 4” x 11 ga. Sq. tubing welded to steel.

h. Painting: Materials equal to. Coronado or equal.
   1) Surfaces: Exterior Door(s), Door Frame(s)
      (a) Primer: Applied by Door Manufacturer.
      (b) Finish: 2 coats acrylic latex semi-gloss enamel applied by press box manufacturer.
   2) Surfaces, Exterior Siding
      (a) Primer: Applied by Siding Manufacturer.
      (b) Finish: Applied by Siding Manufacturer.
      (c) Touchup: If applicable
   3) Surfaces: Wall and Roof Structure
      (a) Primer: Coronado DTM Industrial 180-11 acrylic metal primer applied after welding, or equal.

i. Caulking: Sonneborn NP1 - Polyurethane sealant, All temperature, UV resistant, or equal.

j. Electrical Work:
   1) Submittal drawing shall indicate devices and circuitry.
   2) Fixtures: Recessed 2'x4' static T8 Troffer fluorescent light fixture for use in grid ceiling systems.
   3) Wiring to be in nonmetallic Panduit, or equal. N.E.C. breaker box to be 100 amp service mounted on wall with 2 inch rigid conduit to be stubbed out at back wall of press box ready for service line to be connected.
   4) Service line to Press Box
   5) Electrical outlet(s) installed per NEC shall be standard duty.
   6) Sound, Telephone, Clock, Field Communication: Empty double outlet boxes per N.E.C. with 3/4 inch conduit stubbed out bottom of Press Box for use of Owner.
   7) Outlet boxes to be flush mounted into wall. Any wiring completed on-site will be responsibility of such contractor for inspections. Quantity per plans.
   8) Filming Area/Observation Deck: Weathertight outlet box for cameras. Quantity: Two. Owner shall indicate additional outlets needed.
   9) Provide Electric Baseboard heat in each room. Quantity per plans.

10) Provide in each of the four rooms an emergency combination exit/flood light with battery back-up. Also provide two exterior emergency lights with remote heads.
11) Provide (2) wall mount exterior lights with photocell
12) Provide fire extinguishers rated for proper use alongside each exit door.

3. Filming Area/Observation Deck
   a. Access
      1) Exterior rear stair entrance (Football)
      2) Roof hatch (Baseball)
   b. Roof guardrailing: 42" above walking surface around perimeter of deck attached to 5/8 inch galvanized studs welded to roof support structure.
      1) Guardrailing: black vinyl coated 6 gauge fencing.
   c. Steel framed canopy cover at football press box per plans.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All work performed by technicians experienced in bleacher seating. Project references may be required to verify the quality of finished projects.
   1. Installation with proven experience in the Mid-Atlantic region. Requirement for a minimum of (3) installer references in DE for this project of similar size and scope.

B. Project is only to be installed as per approved shop drawings.

3.02 FIELD QUALITY CONTROL

A. Foundation: Footings for the grandstand shall provide sufficient bearing area at bottom to support all loads of the grandstand. Depth and design of footings have been designed for this project and shall be bid in accordance with the plans and specifications. Hot-dipped galvanized anchor bolts shall be secured in the concrete footings.
   1. Concrete shall attain working strength of 3,500 psi.

3.03 CLEAN-UP

A. Clean up all debris caused by work of this section removed from site.

B. Upon completion of the work and final inspections, bleacher manufacturer shall broom clean the stand removing all loose debris.

C. If broom cleaning does not properly remove dirt and debris from the surface, pressure washing will be required.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1. GENERAL

1.01. SUMMARY

A. All work under Division 22 is subject to the Division 01, *General Requirements, the General Conditions and Supplementary Conditions.*

B. Provide all labor, materials, equipment, and services necessary for and incidental to the complete installation and operation of all plumbing work.

C. Unless otherwise specified, all submissions shall be made to, and acceptances and approvals made by the Architect and the Engineer.

D. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange piping, equipment, and other work generally as shown on the contract drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with *Submittals* specified below. The right is reserved to make reasonable changes in location of equipment, piping, up to the time of rough-in or fabrication.

E. Conform to the requirements of all rules, regulations and codes of local, state and federal authorities having jurisdiction.

F. Coordinate the work under Division 22 with the work of all other construction trades.

G. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the contract documents.

1.02. PERMITS AND FEES

A. Obtain all permits and pay taxes, fees and other costs in connection with the work. File necessary plans, prepare documents, give proper notices and obtain necessary approvals. Deliver inspection and approval certificates to Owner prior to final acceptance of the work.

B. Permits and fees shall comply with the Division 01, *General Requirements* of the specification.

1.03. EXAMINATION OF SITE

A. Examine the site, determine all conditions and circumstances under which the work must be done, and make all necessary allowances for same. No additional cost to the Owner will be permitted for contractors failure to do so.

B. Examine and verify specific conditions described in individual specifications sections.

C. Verify that utility services are available, of the correct characteristics, and in the correct locations.

1.04. CONTRACTOR QUALIFICATION

A. Any Contractor or Subcontractor performing work under Division 22 shall be fully qualified and acceptable to the Architect and Owner. Submit the following evidence when requested:

1. A list of not less than five comparable projects which the Contractor completed.

2. Letter of reference from not less than three registered professional engineers, general contractors or building owners.

3. Local and/or State License, where required.

4. Membership in trade or professional organizations where required.

B. A Contractor is any individual, partnership, or corporation, performing work by contract or subcontract on this project.

C. Acceptance of a Contractor or Subcontractor will not relieve the Contractor or subcontractor of any contractual requirements or his responsibility to supervise and coordinate the work, of various trades.

1.05. MATERIALS AND EQUIPMENT

A. Materials and equipment installed as a permanent part of the project shall be new, unless otherwise indicated or specified, and of the specified type and quality.

B. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish named item, or its equal, subject to approval by Engineer. Substituted items shall be equal or better in quality and performance and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of substituted items, for approval.

C. The suitability of named item only has been verified. Where more than one item is named, only the first named item has been verified as suitable. Substituted items, including items other than first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement and application. Contractor, by providing other than the first named manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation. Adjustments and modifications shall include but not be limited to electrical, structural, support, and architectural work.

D. Substitution will not be permitted for specified items of material or equipment where noted.

E. All items of equipment furnished shall have a service record of at least five (5) years.

1.06. FIRE SAFE MATERIALS

A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA and ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

1.07. REFERENCED STANDARDS, CODES AND SPECIFICATIONS

A. Specifications, Codes and Standards listed below are included as part of this specification, latest edition.

B.	ASHRAE	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
C.	ASME	-	American Society of Mechanical Engineers
D.	ASPE	-	American Society of Plumbing Engineers
E.	ASTM	-	American Society for Testing and Materials
F.	AWWA	-	American Water Works Association
G.	DNREC	-	Delaware Department of Natural Resources and Environmental Control
H.	IBC	-	International Building Code
I.	IEEE	-	Institute of Electrical and Electronics Engineers
J.	MSSP	-	Manufacturers Standards Society of the Valve and Fittings Industry
K.	NEC	-	National Electrical Code
L.	NEMA	-	National Electrical Manufacturers Association
M.	NSF	-	National Sanitation Foundation
N.	UL	-	Underwriters' Laboratories

O. All plumbing equipment and materials shall comply with the codes and standards listed in the latest edition of ASHRAE HVAC Applications Handbook, Chapter entitled *Codes and Standards*.

1.08. SUBMITTALS, REVIEW AND ACCEPTANCE

A. Equipment, materials, installation, workmanship and arrangement of work are subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Architect to be in best interest of Owner.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product

that is regional. See Division 01 Sections related to LEED.

1.09. SHOP DRAWINGS

A. Prepare and submit shop drawings for all plumbing equipment, specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings, or where the proposed installation differs from that shown on contract drawings.

B. Submit data and shop drawings including but not limited to the list below, in addition to provisions of the paragraph above. Identify all shop drawings by the name of the item and system and the applicable specification paragraph number and drawing number.

C. Every submittal including, but not limited to the list below, shall be forwarded with its own transmittal as a separate, distinct shop drawing. Grouping of items/systems that are not related shall be unacceptable.

D. Items and Systems

Access Doors/Panels including layout and location
Automatic Temperature Control System and Equipment as it relates to plumbing system
Backflow Preventers
Coordinated Drawings
Direct Buried Piping
Domestic Water Expansion Tanks
Domestic Water Heaters
Drip Pans
Fire Stopping - Methods and Materials
Floor and Roof Drains
Hose Bibbs and Wall Hydrants
Identification System
In-Line Circulators
Material and Equipment List
Operations and Maintenance Manuals
Pipe Materials Including Itemized Schedule
Plumbing Fixtures & Trim
Preliminary Testing and Balancing Report
Pressure Relief Valves
Roof Drains
Schrader Fitting Valves
Test Certificates
Thermal Insulation Materials Include Table Summary
Thermometers and Gauges
Thermostatic Mixing Valves
Trap Priming Station
Valves
Water Meters
Wiring Diagrams, Flow Diagrams and Operating Instructions

E. Contractor, additionally, shall submit for review any other shop drawings as required by the Architect. No item shall be delivered to the site, or installed, until the Contractor has

received a submittal from the Engineer marked *Reviewed* or *Comments Noted*. After the proposed materials have been reviewed, no substitution will be permitted except where approved by the Architect.

1.10. CUTTING AND PATCHING

A. Accomplish all cutting and patching necessary for the installation of work under Division 22. Damage resulting from this work to other work already in place, shall be repaired at Contractor's expense. Where cutting is required, perform work in neat and workmanlike manner. Restore disturbed work to match and blend with existing construction and finish, using materials compatible with the original. Use mechanics skilled in the particular trades required.

B. Do not cut structural members without approval from the Architect or Engineer.

1.11. PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls, and interior waterproof construction. Where such penetrations are necessary, furnish and install all necessary curbs, sleeves, flashings, fittings and caulking to make penetrations absolutely watertight.

B. Where plumbing vents or other pipes penetrate roofs, flash pipe with Stoneman *Stormtite*, Pate or approved equal, roof flashing assemblies with skirt and caulked counter flashing sleeve.

C. Furnish and install pitch pockets or weather tight curb assemblies where required.

D. Furnish and install roof drains, curbs, and vent assemblies specifically designed for application to the particular roof construction, and install in accordance with the manufacturer's instructions. The Contractor shall be responsible for sleeve sizes and locations. All roof penetrations shall be installed in accordance with manufacturer’s instructions, the National Roofing Contractors Association, SMACNA, and as required by other divisions of these specifications.

1.12. CONCRETE AND MASONRY WORK

A. Furnish and install concrete and masonry work for equipment foundations, supports, pads, and other items required under Division 22. Perform work in accordance with requirements of other applicable Divisions of these specifications.

B. Concrete shall test not less than 3,000 psi compressive strength after 28 days.

C. Grout shall be non-shrink, high strength mortar, free of iron of chlorides and suitable for use in contact with all metals, without caps or other protective finishes. Apply in accordance with manufacturer's instructions and standard grouting practices.

1.13. EXCAVATION AND BACKFILLING

A. GENERAL

1. Perform all necessary excavation, or installation of work under Division 22, in whatever materials or conditions encountered, using suitable methods and equipment.

2. Accurately establish required lines and grades and properly locate the work.

3. Determine the locations of all existing utilities before commencing the work.

B. Excavation: (Refer also to other portions of the specifications)

1. Excavate only the required elevations. If excavation is carried below the foundation lines or other required limits, backfill the excess with concrete.

2. Keep banks of trenches as nearly vertical as possible, and provide sheeting and/or shoring as required for protection of work and safety of personnel. Follow local, State, and OSHA Guidelines.

3. Keep excavations dry. Protect excavations from freezing.

C. Backfilling: (Refer also to other portions of the specifications)

1. Backfill excavations to the required elevations and restore surfaces to their original or required conditions.

2. Backfill shall be similar material, free from objectionable matter such as rubbish, roots, stumps, brush, rocks and other sharp objects. Unless otherwise indicated, suitable material from the excavation may be used for backfill.

3. Carefully place and mechanically tamp backfill in layers not exceeding 12 inches loose thickness. Compact to 95 percent minimum.

4. Do not backfill against frozen material. Do not use frozen material for backfill.

1.14. VIBRATION ISOLATION

A. Furnish and install vibration isolators, flexible connections, supports, anchors and/or foundations required to prevent transmission of vibration from equipment, or piping to building structure. See Division 23 Section, *Vibration Controls for HVAC, Plumbing and Fire Protection.*

1.15. ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

1.16. FASTENERS

A. All fasteners located in public spaces including locker rooms, corridors, lobbies, etc., shall be provided with tamper proof fasteners. Provide Pin Phillips hardware as manufactured by Challenge Industries or approved equal.

1.17. DEFINITIONS

A. *Approve* - to permit use of material, equipment or methods conditional upon compliance with contract documents requirements.

B. *Furnish and install* or *provide* means to supply, erect, install, and connect to complete for readiness for regular operation, the particular work referred to.

C. *Contractor* means the mechanical contractor and any of his subcontractors, vendors, suppliers, or fabricators.

D. *Piping* includes pipe, all fittings, valves, hangers, insulation, identification, and other accessories relative to such piping.

E. *Concealed* means hidden from sight in chases, formed spaces, shafts, hung ceilings, embedded in construction or attic.

F. *Exposed* means not installed underground or *concealed* as defined above.

G. *Invert Elevation* means the elevation of the inside bottom of pipe.

H. *Finished Spaces*: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceiling, unexcavated spaces, crawl spaces, and tunnels.

I. *Review* - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

J. *Building Line:* Exterior wall of building.

1.18. MINIMUM EFFICIENCY REQUIREMENTS

A. All plumbing equipment shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

B. All piping and equipment insulation shall comply with ASHRAE Standard 90.1, latest edition.

C. All service water/heating equipment shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

D. All plumbing devices, controls, accessories, and components shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

1.19. LEED REQUIREMENTS

A. Refer to Division 01 Section, “LEED Requirements” for description of work under this Division affected by LEED requirements.

1.20. LEED SUBMITTALS

A. Product data for Credit EQ 4.1: For adhesives, welding solvents, and sealants applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.

B. Product data for Credit EQ 4.2: For paints and coatings applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.

1.21. SYSTEM INTEGRATION

A. For all plumbing equipment specified to be provided with packaged controls and interfaced with the automatic temperature control system, provide system integration between the equipment manufacturer and the automatic temperature control subcontractor.

B. Plumbing equipment submittals requiring system integration as defined above must identify all required system integration points.

C. Plumbing equipment manufacturers must coordinate with ATC subcontractor regarding system integration prior to submitting on the equipment.

D. A system integration meeting must be arranged by the Mechanical Contractor and include, but not be limited to the systems integrator for the plumbing equipment manufacturer and the ATC Subcontractor. This portion of systems integration must occur prior to plumbing equipment being delivered to the project.

E. Once the plumbing equipment is on site, a second systems integration meeting must be arranged by the Mechanical Contractor to coordinate the packaged controls with the ATC system. The plumbing equipment manufacturer's representative familiar with system integration and the ATC subcontractor familiar with programming must be present.

F. A final system integrations meeting shall occur once all equipment is in place and ready for operation. The Mechanical Contractor, the plumbing equipment systems' integrator, and the ATC Subcontractor shall meet on site to jointly program, schedule, verify points, interlock devices, and fully set up all systems integration components.

G. All systems integration coordination, programming, and graphics must be completed prior to requesting commissioning and/or inspections by the Engineer of Record.

1.22. LEAD FREE REQUIREMENTS

A. All plumbing fixtures, equipment, and devices that contact potable water must be lead free per the State requirements.

PART 2. ELECTRICAL REQUIREMENTS

2.01. GENERAL MOTOR AND ELECTRICAL REQUIREMENTS

A. Furnish and install control and interlock wiring for the equipment furnished. In general, power wiring and motor starting equipment will be provided under Division 26.

Carefully review the contract documents to coordinate the electrical work under Division 22 with the work under Division 26. Where the electrical requirements of the equipment furnished differ from the provisions made under Division 26, make the necessary allowances under Division 22. Where no electrical provisions are made under Division 26, include all necessary electrical work under Division 22.

B. All electrical work performed under Division 22 shall conform to the applicable requirements of Division 26 and conforming to the National Electric Code. All wiring, conduit, etc., installed in ceiling plenums must be plenum rated per NFPA & International Building Code.

C. Provide wiring diagrams with electrical characteristics and connection requirements.

D. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than five (5) horsepower.

E. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

F. All motors shall be furnished with visible nameplate indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor and efficiency.

G. Nominal efficiency and power factor shall be as scheduled at full load and rated voltage when tested in accordance with IEEE 112.

H. Brake horsepower load requirement at specified duty shall not exceed 85 percent of nameplate horsepower times NEMA service factor for motors with 1.0 and 1.15 service factors.

I. All single phase motors shall be provided with thermal protection: Internal protection shall automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature ratings of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range, unless otherwise indicated.

2.02. MOTORS AND CONTROLS

A. Motors and controls shall conform to the latest requirements of IEEE, NEMA, NFPA-70 and shall be UL listed. Motor sizes are specified with the driven equipment. Motor starting and control equipment is specified either with the motor which is controlled or in an electrical specification section. The Contractor is advised to consult all specification sections to determine responsibility for motors and controls.

B. Motors shall be designed, built and tested in accordance with the latest revision of NEMA Standard MG l.

C. Motors shall be suitable for use under the conditions and with the equipment to which applied, and designed for operation on the electrical systems specified or indicated.

1. Motor capacities shall be such that the horsepower rating and the rated full-load current will not be exceeded while operating under the specified operating conditions. Under no condition shall the motor current exceed that indicated on the nameplates.

2. Motor sizes noted in the individual equipment specifications are minimum requirements only. It is the responsibility of the equipment manufacturers and of the Contractor to furnish motors, electrical circuits and equipment of ample capacity to operate the equipment without overloading, exceeding the rated full-load current, or overheating at full-load capacity under the most severe operating service of this equipment. Motors shall have sufficient torque to accelerate the total WR^2 of the driven equipment to operating speed.

3. Motors shall be continuous duty type and shall operate quietly at all speeds and loads.

4. Motors shall be designed for operation on 60 hertz power service. Unless otherwise specified or shown, motors less than ½ horsepower shall be single phase, and motors ½ horsepower and larger shall be 3 phase unless otherwise noted.

5. Motors shall be mounted so that the motor can be removed without removing the entire driven unit.

D. Single phase motors, smaller than 1/20 horsepower shall be ball or sleeve bearing; drip-proof, totally enclosed or explosion proof, as specified; 120 volts; permanent-split capacitor or shaded pole type. These motors shall not be used for general power purposes, and shall only be provided as built-in components of plumbing equipment. When approved by the Engineer, deviations from the specifications will be permitted as follows:

1. Open motors may be installed as part of an assembly where enclosure within a cabinet provides protection against moisture.

2. Motors used in conjunction with low voltage control systems may have a voltage rating less than 115 volts.

E. Single phase motors, greater than 1/20 horsepower and less than ½ horsepower shall be ball bearing; drip-proof, totally enclosed or explosion proof, as specified, with Class A or B insulation, as standard with the motor manufacturer; 115 or 120/208/240 volts as required; capacitor start-induction run, permanent split capacitor, or repulsion start-induction run type with minimum efficiency of 70 percent and a minimum full load power of 77 percent.

F. Except as otherwise specified in the various specification sections, 3 phase motors 60 horsepower and smaller shall be NEMA design B squirrel cage induction type meeting the requirements of this paragraph. Motors shall be drip-proof, totally enclosed or explosion proof, as specified or indicated. Insulation shall be Class B or F, at 40 degrees C ambient temperature. Drip-proof motors shall have a 1.15 service factor and totally enclosed and explosion proof motors shall have a service factor of 1.00 or higher. Motors specified for operation at 480, 240, and 208 volts shall be nameplated 460, 230,

200 volts, respectively. Efficiencies and percent power factor at full load for three phase motors shall be not less than the values listed below for premium efficiency motors:

MOTOR NAMEPLATE	MINIMUM PERCENT EFFICIENCY AT NOMINAL SPEED AND RATED LOAD	MINIMUM PERCENT POWER FACTOR
1HP and above to	85.5 percent	84 percent
1-½ HP	86.5 percent	85 percent
2HP	86.5 percent	85 percent
3HP	89.5 percent	86 percent
5HP	89.5 percent	87 percent
7½ HP	91 percent	86 percent
10HP	91.7 percent	85 percent
15HP	93.0 percent	85 percent
20HP	93.0 percent	86 percent
25HP	93.6 percent	85 percent
50HP	94.5 percent	88 percent
60 HP	95.0 percent	90 percent
75HP	95.0 percent	90 percent
100 HP	95.4 percent	90 percent
125 HP	95.8 percent	95 percent
150 HP and above	96.0 percent	95 percent

G. Three phase motors ½ HP or greater shall be the Duty Master XE by Reliance Electric Company, Super-E Premium Efficiency of Baldor Motor and Drives, E-plus Efficient Standard Duty Motor of the Electric Motor Division of Gould, Inc., the MAC II High Efficiency motor of Westinghouse Electric Corp., the equivalent product of General Electric, or approved equal.

H. For motors serving equipment being controlled by a variable speed drive, motor shall be premium efficiency inverter duty rated.

I. Motor frames shall be NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast-iron or aluminum with steel inserts.

J. Control of each motor shall be manual or automatic as specified for each in the various mechanical sections. In general, and unless otherwise specified for a particular item in the various mechanical sections of the specifications, motor starters and controls shall be specified and provided under the various electrical sections of these specifications.

2.03. MOTOR INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors to support shaft regardless of shaft position.

C. Check line voltage and phase and ensure agreement with nameplate. Check that proper thermal overloads have been installed prior to operating motors.

2.04. WIRING DIAGRAMS

A. The Contractor is responsible for obtaining and submitting wiring diagrams for all major items of equipment.

B. Wiring diagrams shall be provided with shop drawings for all equipment requiring electric power.

C. Provide wiring diagrams for all major plumbing items of equipment to electrical contractor and ATC subcontractor for coordination.

PART 3. EXECUTION

3.01. EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

3.02. SUPPORTS, HANGERS AND FOUNDATIONS

A. Provide supports, hangers, braces, attachments and foundations required for the work. Support and set the work in a thoroughly substantial and workmanlike manner without placing strains on materials, equipment, or building structure, submit shop drawings for approval. Coordinate all work with the requirements of the structural division.

B. Supports, hangers, braces, and attachments shall be standard manufactured items or fabricated structural steel shapes. All interior hangers shall be galvanized or steel with rust inhibiting paint. For un-insulated copper piping provide copper hanger to prevent

contact of dissimilar metals. All exterior hangers shall be constructed of stainless steel utilizing stainless steel rods, nuts, washers, bolts, etc.

C. Concrete housekeeping pads and foundations shall be not less than 4 inches high and shall extend a minimum of 6 inches beyond equipment bases. Provide wire-mesh reinforcement; chamfer exposed edges and corners; and finish exposed surfaces smooth.

3.03. DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a videographer to record demonstration and training video recordings. Record each training module separately.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Engineer

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

3.04. PROVISIONS FOR ACCESS

A. The contractor shall provide access panels and doors for all concealed equipment, valves, strainers, dampers, controls, control devices, cleanouts, traps, and other devices requiring maintenance, service, adjustment, balancing or manual operation.

B. Where access doors are necessary, furnish and install manufactured painted steel door assemblies consisting of hinged door, key locks, and frame designed for the particular wall or ceiling construction. Properly locate each door. Door sizes shall be a 12 inches x 12 inches for hand access, 18 inches x 18 inches for shoulder access and 24 inches x 24 inches for full body access where required. Review locations and sizes with Architect prior to fabrication. Provide U.L. approved and labeled access doors where installed in fire rated walls or ceilings. Doors shall be Milcor Metal Access Doors as manufactured by Inland-Ryerson, Mifab, or approved equal.

1. Acoustical or Cement Plaster: Style B
2. Hard Finish Plaster: Style K or L
3. Masonry or Dry Wall: Style M

C. Where access is by means of liftout ceiling tiles or panels, mark each ceiling grid using small color-coded and numbered tabs. Provide a chart or index for identification. Place markers within ceiling grid <u>not</u> on ceiling tiles.

D. Access panels, doors, etc. described herein shall be furnished under the section of

specifications providing the particular service and to be turned over to the pertinent trade for installation. Coordinate installation with installing contractor. All access doors shall be painted in baked enamel finish to match ceiling or wall finish.

E. Submit shop drawings indicating the proposed location of all access panels/doors. Access doors in finished spaces shall be coordinated with air devices, lighting and sprinklers to provide a neat and symmetrical appearance.

3.05. PAINTING AND FINISHES

A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc. shall be stainless steel.

B. Clean surfaces prior to application of insulation, adhesives, coatings, paint, or other finishes.

C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pretreatment.

D. Protect all finishes and restore any finishes damaged as a result of work under Division 22 to their original condition.

E. The preceding requirements apply to all work, whether exposed or concealed.

F. Remove all construction marking and writing from exposed equipment, piping and building surfaces. Do not paint manufacturer's labels or tags.

G. All exposed piping, equipment, etc. shall be painted. Colors shall be as stated in this division or as selected by the Architect and conform to ANSI Standards.

H. All exterior roof mounted equipment, piping and vents shall be painted to match roof in color as selected by Architect.

I. All exposed piping, equipment, etc. in finished spaces shall be painted. Colors shall be as selected by the Architect and conform to ANSI Standards.

J. All exposed piping, equipment, etc., in mechanical rooms, janitor’s closets, utility rooms, and storage where PVC jacketed shall not require painting. Label and identify and color code as specified.

1. Field-applied paints and coatings within the building interior: Comply with low-emitting requirements in Division 01 Section, “Indoor Air Quality Requirements”.

3.06. CLEANING OF SYSTEMS

A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers, and other accessory items. Blow out and flush piping until interior surfaces are free of foreign matter.

B. Flush piping in re-circulating water systems to remove cutting oil, excess pipe joint compound, solder slag and other foreign materials. Do not use system pumps until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling, the residual alkalinity shall not exceed 300 parts per million. Submit a certificate of completion to Engineer stating name of service company used.

C. Maintain strainers and dirt pockets in clean condition.

D. Pay for labor and materials required to locate and remove obstructions from systems that are clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.

E. Leave systems clean, and in complete running order.

3.07. COLOR SELECTION

A. Color of finishes shall be as selected by the Architect.

B. Submit color of factory-finished equipment for acceptance prior to ordering.

3.08. PROTECTION OF WORK

A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.

B. Cover temporary openings in piping and equipment to prevent the entrance of water, dirt, debris, or other foreign matter. Deliver pipes and tubes with factory applied end caps.

C. Cover or otherwise protect all finishes.

D. Replace damaged materials, devices, finishes and equipment.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, where stored inside.

3.09. OPERATION OF EQUIPMENT

A. Clean all systems and equipment prior to initial operation for testing, balancing, or other purposes. Lubricate, adjust, and test all equipment in accordance with manufacturer's instructions. Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.

B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment. Where factory start-up of equipment is not specified, provide field start-up by qualified technician.

C. Submit factory start-up sheets or field start-ups sheets for all equipment prior to the

commencement of testing and balancing work. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

D. Do not use plumbing systems for temporary services or temporary conditioning during construction. Refer to Division 01 section *"Temporary Facilities and Controls"* for temporary plumbing during construction.

E. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items such as filters.

3.10. IDENTIFICATIONS, FLOW DIAGRAMS, ELECTRICAL DIAGRAMS AND OPERATING INSTRUCTIONS

A. Contractor shall submit for approval schematic piping diagrams of each piping system installed in the building. Diagrams shall indicate the location and the identification number of each valve in the particular system. Following approval by all authorities, the diagrams shall be framed, mounted under safety glass and hung in each Mechanical Room where directed. Contractor shall deliver the tracing or sepia from which the diagrams were reproduced to the Owner.

B. All valves shall be plainly tagged. For any bypass valves, install sign indicating valve position as “Normally Open” or “Normally Closed” as required.

C. All items of equipment, including motor starters and disconnects shall be furnished with white on black plastic permanent identification cards. Lettering shall be a minimum of ¼ inch high. Identification plates shall be secured, affixed to each piece of equipment, starters, disconnects, panels by screw or adhesive (tuff bond #TB2 or as approved equal). Equipment identification and room name or area served shall be on each panel.

D. Provide six (6) copies of operating and maintenance instructions for all principal items of equipment furnished. This material shall be bound as a volume of the *Operations and Maintenance Manuals* as hereinafter specified.

E. All lines piping installed under this contract shall be stenciled with *direction of flow* arrows and with stenciled letters naming each pipe and service. Refer to Division 22 Section, *Plumbing Piping, Fittings, Valves, Etc*. Color code all direction of flow arrows and labels. In finished spaces omit labeling and direction of flow arrows. Paint in color as selected by Architect.

F. Submit list of wording, symbols, letter size, and color coding for plumbing identification. Submit samples of equipment identification cards, piping labels, labels, and valve tags to Engineer for review prior to installation.

G. Provide at least eight (8) hours of straight time instruction to the operating personnel. Time of instruction shall be designated by the Owner. Additional instruction time for the automatic temperature control (ATC) system is specified in Division 23 Section, *Instrumentation and Controls of HVAC and Plumbing Systems*.

H. Contractor shall demonstrate Sequences of Operation of all plumbing equipment in presence of Owner’s representative, Commissioning Authority, and ATC subcontractor.

3.11. WALL AND FLOOR PENETRATION

A. All penetrations of partitions, ceilings, roofs and floors by piping or conduit under Division 22 shall be sleeved, sealed, and caulked airtight for sound and air transfer control. Penetrations of mechanical room partitions, ceilings, and floors shall be as specified in Division 07 Section, *HVAC and Plumbing Penetration Firestopping*.

B. All penetration of fire rated assemblies shall be sleeved, sealed, caulked and protected to maintain the rating of the wall, roof, or floor. Fire Marshal approved U.L. assemblies shall be utilized. See Division 07 Section, *HVAC and Plumbing Penetration Firestopping.*

C. Where piping extends through exterior walls or below grade, provide waterproof pipe penetration seals, as specified in another division of these specifications.

D. Provide pipe escutcheons and duct flanges for sleeved pipes and ducts in finished areas.

E. Piping sleeves:

1. Galvanized steel pipe, standard weight where pipes are exposed and roofs and concrete and masonry walls. On exterior walls provide anchor flange welded to perimeter.

2. Twenty-two (22) gauge galvanized steel elsewhere.

3.12. RECORD DRAWINGS

A. Upon completion of the mechanical installations, the Contractor shall deliver to the Architect one complete set of prints of the mechanical contract drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings.

B. Contractor shall incorporate all sketches, addendums, value engineering, change orders, etc., into record drawings prior to delivering to Architect.

3.13. WARRANTY

A. Contractor's attention is directed to warranty obligations contained in the *General Conditions and Supplementary Conditions*.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of equipment manufacturer’s warranties shall be included in the operations and maintenance manuals.

C. The contractor guarantees for a two year period from the time of final acceptance by the Owner.

1. That the work contains no faulty or imperfect material or equipment or any imperfect, careless, or unskilled workmanship.

2. That all work, equipment, machines, devices, etc. shall be adequate for the use to which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.

3. That the contractor will re-execute, correct, repair, or remove and replace with proper work, without cost to the Owner, any work found to be deficient. The contractor shall also make good all damages caused to their work or materials in the process of complying with this section.

4. That the entire work shall be water-tight and leak-proof.

3.14. LUBRICATION

A. All bearings, motors, and all equipment requiring lubrication shall be provided with accessible fittings for same. Before turning over the equipment to the Owner, the Contractor shall fully lubricate each item of equipment, shall provide one year's supply of lubricant for each, and shall provide Owner with complete written lubricating instructions, together with diagram locating the points requiring lubrication. Include this information in the *Operations and Maintenance Manuals*.

B. In general, all motors and equipment shall be provided with grease lubricated roller or ball bearings with Alemite or equal accessible or extended grease fittings and drain plugs.

3.15. OPERATIONS AND MAINTENANCE MANUALS

A. The Contractor shall have prepared six (6) copies of the *Operations and Maintenance Manuals* and deliver these copies of the manuals to the Owner. The manuals shall be as specified herein. The manuals must be approved and will not be accepted as final until so stamped.

B. The manuals shall be bound in a three-ring loose-leaf binder similar to National No. 3881 with the following title lettered on the front: *Operations and Maintenance Manual Dover High School Outbuildings - Bid Pack G – Plumbing Systems.* No sheets larger than 8-1/2 inches x 11 inches shall be used, except sheets that are neatly folded to 8-1/2 inches x 11 inches and used as a pull-out. Provide divider tabs and table of contents for organizing and separating information.

C. Provide the following data in the booklet:

1. As first entry, an approved letter indicating the starting/ending time of Contractor’s warranty period.
2. Catalog data on each piece of plumbing equipment furnished.
3. Maintenance operation and lubrication instructions on each piece of plumbing equipment furnished.
4. Complete catalog data on each piece of plumbing equipment furnished including approved shop drawing.
5. Manufacturer's extended limited warranties on equipment including but not limited to water heaters.
6. Chart form indicating frequency and type of routine maintenance for all plumbing equipment. The chart shall also indicate model number of equipment,

location and service.

7. Provide sales and authorized service representatives names, address, and phone numbers of all equipment and subcontractors.
8. Provide supplier and subcontractor's names, address, and phone number.
9. Catalog data of all equipment, valves, etc. shall include wiring diagrams, parts list and assembly drawing.
10. Provide and install in locations as directed by the Owner, valve charts including valve tag number, valve type, valve model number, valve manufacturer, style, service and location. Each valve chart shall be enclosed in a durable polymer based frame with a cover safety glass. .
11. Copy of the approved balancing report for plumbing equipment/system.
12. Access panel charts with index illustrating the location and purpose of access panels.
13. Approved Health and Plumbing and Electrical Certificates.
14. Start-up reports for equipment.
15. Insert color graphic with embedded parameters for ATC system into Record and Information Booklet.

D. Submit *Operations and Maintenance Manuals* prior to the anticipated date of substantial completion for Engineer review and approval. Substantial completion requires that *Operations and Maintenance Manuals* reviewed and approved.

3.16. INSTALLATION AND COORDINATION DRAWINGS

A. Prepare, submit, and use composite installation and coordination drawings to assure proper coordination and installation of work. Drawings shall include, but not be limited, to the following:

1. Complete Plumbing and HVAC Piping Drawings showing coordination with lights, electrical equipment, HVAC equipment and structural amenities.

B. Draw plans to a scale not less than 3/8-inch equals one foot. Include plans, sections, and elevations of proposed work, showing all equipment, and piping in areas involved. Fully dimension all work including lighting fixtures, conduits, pullboxes, panelboards, and other electrical work, walls, doors, ceilings, columns, beams, joists and other architectural and structural work.

C. Identify all equipment and devices on wiring diagrams and schematics. Where field connections are shown to factory-wired terminals, include manufacturer's literature showing internal wiring.

3.17. PIPING SYSTEMS TESTING

A. The entire new plumbing piping systems shall be tested hydrostatically before insulation covering is applied and proven tight under the following gauge pressures for a duration of four (4) hours. Testing to be witnessed by Owner's representative and documented in writing.

SYSTEM	TEST PRESSURE
Domestic Water & Coil Drain Piping	100 psi

SYSTEM	TEST PRESSURE
Sanitary & Storm Water Piping	As specified below

B. All storm, waste, vent and water piping shall be tested by the Contractor and approved by the Engineer before acceptance. All storm, soil, and waste piping, located underground, shall be tested before backfilling. The costs of all equipment required for tests are to be included in the contract price.

C. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest stack above or at the roof. The system shall hold this water for thirty (30) minutes without showing a drop greater than 1inch. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure. The pressure shall be maintained for thirty (30) minutes. All testing shall be in accordance with the local Plumbing Code and witnessed by the Plumbing Inspector or authority having jurisdiction.

D. Upon completion of roughing-in and before setting equipment and fixtures, the entire new water piping system shall be tested at a hydrostatic pressure of not less than one hundred (100) pounds per square inch gauge and proven tight at this pressure. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.

E. Testing and acceptance thereof shall be in accordance with local requirements and shall meet approval of authority having jurisdiction. Submit certificates and approved permits and insert one (1) copy in the *Operations and Maintenance Manuals*.

3.18. EQUIPMENT BY OTHERS

A. This Contractor shall make all system connections required to equipment furnished and installed under other divisions or furnished by the Owner. Connections shall be complete in all respects to render this equipment functional to its fullest intent.

B. It shall be the responsibility of the supplier of this equipment to furnish complete instructions for connections. Failure to do so will not relieve this contractor of any responsibility for improper equipment operation.

END OF SECTION

SECTION 22 05 05

PLUMBING PIPING, FITTINGS AND VALVES

PART 1. GENERAL

1.01. RELATED DOCUMENTS

A. This project is to be LEED certified. Refer to Division 01 Sections, including "Sustainable Design Requirements", "Construction Waste Managements", and "Commissioning Requirements" for mandatory work which may apply to all contractors, installers, and suppliers.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product data for Credit EQ 4.2: For paints and coatings applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.

3. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.02. SUMMARY

A. The conditions of the contract and other general requirements apply to the work specified in this section. All work under this section shall also be subject to the requirements of Division 22 Section, Common Work Results for Plumbing and Division 01, *General Requirements*.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03. SYSTEM DESCRIPTION CONDITIONS

A. Provide all labor and materials necessary to furnish and install all piping systems on this project as herein specified and/or shown on the drawings. Final connections to equipment furnished in other sections of the specifications shall be included under this section.

B. All piping and insulation installed in ceiling plenums must be plenum rated and comply with NFPA and International Building Code (IBC).

C. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide

necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

D. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

E. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

F. Provide pipe hangers and supports in accordance with ASTM B31.9 and MSS SP69 unless indicated otherwise.

G. Use spring loaded "silent" check valves on discharge of all pumps.

H. Use 3/4 inch (20 mm) ball valves with threaded ends, cap, and chain for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain. For the outbuildings that will be drained in the winter install Schrader valves, ball valves, and a drain values to allow complete drainage of all water containing piping.

I. At all runout piping serving equipment, use swing joints with elbows to prevent excessive movement of piping due to expansion.

1.04. QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

C. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.

D. Maintain one copy of each document on site.

1.05. DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under as hereinbefore specified.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed systems.

1.06. ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.07. ALTERNATES

A. Refer to Division 01 - *Alternates* for description of work under this section affected by alternates.

1.08. LEED REQUIREMENTS

A. Refer to Division 01 Section LEED Requirements for description of work under this Division affected by LEED requirements.

1.09. LEAD FREE REQUIREMENTS

A. All plumbing fixtures, equipment, and devices that contact potable water must be lead free per the State requirements.

PART 2. PRODUCTS

2.01. PIPE MATERIALS

A. All materials, unless otherwise specified, shall be new and of the best quality of their respective kinds, and shall conform to the requirements and ordinances of local, state and insurance authorities having jurisdiction.

1. Sanitary Underground - Within Building to 5 Feet Outside of Foundation Wall:

   a). PVC Pipe: Schedule 40 DWV or cellular core. Fittings: Schedule 40 PVC, ASTM D 2665 or ASTM F891 socket fittings. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2. Sanitary and Vents Above Floor Inside Building:

   a). Pipe & Fittings: Cast iron *No-Hub* pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International as compliant with CISPI 301, ASTM C564. Installation and support shall be in accordance with Cast Iron Soil Pipe Institute recommendation. Joints shall be made with neoprene gaskets and stainless steel clamp and shield assemblies listed by NSF International as compliant with CISPI 310. Sealing sleeve shall be polychloroprene (neoprene) based rubber sleeve conforming to ASTM C564.

   b). Hubless Cast Iron Soil Pipe and Fittings
      i. Hubless pipe and fittings must be listed by NSF International as compliant with CISPI 301.
      ii. Manufacturers:
         1) AB&I
         2) Charlotte

3) Tyler

c). Medium Duty Shielding Coupling, ASTM C 1540, Type 304 Stainless Steel corrugated shield and bands, and polychloroprene (neoprene) based rubber sleeve conforming to ASTM C564.
   i. Approved manufacturers:
      1) Clamp-All
      2) Mission Rubber Company
      3) Anaco

3. Indirect Waste Piping:

   a). Pipe & Fittings: Hard drawn Type L copper tubing with cast brass drainage fittings. ASTM B88-78 and ANSI B16.1877. All exposed indirect waste piping shall be chrome plated or primed and painted with silver paint.

4. Storm Water Below Grade or Under Building to Point 5 Feet from Building Line:

   a). PVC Pipe: Schedule 40 DWV or cellular core. Fittings: Schedule 40 PVC, ASTM D 2665 or ASTM F891 socket fittings. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

5. Storm Water Above Floor Inside Building:

   a). Pipe & Fittings: Cast iron *no-hub*, pipe and fittings, CISPI 301. Installation and support shall be in accordance with Cast Iron Soil Pipe Institute recommendations. Joints shall be made with neoprene gaskets and stainless steel clamp and shield assemblies listed by NSF International as compliant with CISPI 310.

   b). Hubless Cast Iron Soil Pipe and Fittings
      i. Hubless pipe and fittings must be marked with the Cast Iron Soil Pipe Institute and listed by NSF International as compliant with CISPI 301.
      ii. Manufacturers:
         1) AB&I
         2) Charlotte
         3) Tyler

   c). Medium Duty Shielding Coupling, ASTM C 1540, Type 304 Stainless Steel corrugated shield and bands, and polychloroprene (neoprene) based rubber sleeve conforming to ASTM C564.
      i. Approved manufacturers:
         1) Clamp-All
         2) Mission Rubber Company
         3) Anaco

6. Domestic Cold Water Outside of Building Below Ground or Under Building to Point 5 Feet from Building Line:

a). Pipe: 2-1/2 inches & smaller, soft temper type *K*. ASTM B88 - No joints below grade except as approved by the Engineer.

3 inches & larger, ductile iron pipe for water, ANSI 21.50 & 21.51 with double thickness cement mortar lining, ANSI 21.4.

b). Fittings & Joints: wrought copper solder joint fittings, ANSI B16.22. Joints for copper piping shall be ASTM B32, SOLDER, grade 95TA.

Cast iron pressure fittings, ANSI 21.10, Class 250. Mechanical specification for mechanical joint for cast iron pressure pipe & fittings ANSI A21.11. Joints for ductile iron pipe shall be AWWA C111, rubber gasket with 3/4 inch diameter rods.

7. Domestic Hot, Cold, and Recirc., Water Piping Inside Buildings, Above Grade:

a). Pipe or Tubing: 2 inches & smaller, all water lines soft temper Type *K* copper tubing below ground, hard temper Type *L* copper tubing above ground, ASTM B88, or Type 304/304L, Schedule 10S, stainless steel to ASTM A312.

2-1/2 inches & larger, hot dipped galvanized steel A120, ASTM A53, Grade B, Schedule 40 steel, or hard copper tube, Type L with copper-tube dimensioned grooved ends; copper ground - end fittings; copper tubing, keyed couplings; and grooved joints. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)

Provide dielectric fittings between steel and copper. Victaulic Style 47 or approved equal.

b). Fittings & Joints: Copper tubing fittings and joints shall be solder type wrought copper - 95-5 silver solder or braze (lead and antimony based solders are prohibited). Galvanized steel pipe fittings and joints shall be ANSI B16.12 hot dipped galvanized threaded ends and 125 lb. galvanized cast iron fittings or 150 lb. galvanized malleable iron.

i. Stainless steel fittings shall be Vic-Press or approved equal for Schedule 10S pipe. Fittings shall be precision, cold drawn, stainless steel with EPDM O-ring seals. (Seals shall be UL classified in accordance with ANSI/NSF61 for Potable Water service.) Fittings rated for working pressures to 500-psi.

ii. Grooved joint couplings shall consist of two ductile iron housing segments cast with offsetting angle pattern bolt pads, FlushSeal elastomer gasket, and ASTM A449 electroplated steel bolts and nuts. (Gasket shall be UL classified in accordance with ASNI/NSF61 for Potable Water service.) Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 607H or approved equal.

c). Gate Valves: 2-1/2 inches & larger - OS&Y, IBBM flanged, 125 lb. standard solid wedge.

2 inches & smaller - bronze solder end, bronze body, solid wedge, rising stem, 200 lb. w.o.g. non-shock. However, use brass valves only on all copper pipe.

d). Butterfly Valves: Cast bronze body to ASTM B584, elastomer coated ductile iron disc with integrally cast stem, with copper-tube dimensioned grooved ends, suitable for working pressures to 300-psig CWP Victaulic Style 608 or approved equal.

e). Ball Valves: Shut-off valves 2-inches and smaller shall be ball valves. Ball valves shall be 150 lbs, brass or bronze body, standard port, 2 piece body, TFE seats with bronze trim. Ball valves shall be threaded end or solder end, or Vic-Press end as required to accommodate piping. Ball valves shall be as manufactured by Victaulic, Conbraco, Crane, Apollo, Nibco, Watts or engineer approved equal.

f). Unions: 2-1/2 inches & larger - 150 lb. brass companion flanges.

2 inches & smaller - wrought copper, ground joint solder ends; threaded hexagonal stainless steel union with Vic-Press ends, Victaulic P589 or approved equal.

g). Check Valves: 2-1/2 inches & larger - IBBM, 125 lb. std. flanged bronze swing check, with metal disc; 2-inches and smaller - 125 lb. std. screwed or solder ends.

h). Globe Valves: 2 inches and smaller, bronze body, bronze trim, rising stem, hand wheel, inside screw, renewable composition disc, solder ends, 150 lb, with back seating capacity.

2 inches & larger: IBBM, 150 lb, bronze trim, rising stem, handwheel OS&Y, plug type disc, flanged ends, renewable seat and disc.

Globe valves shall be Conbraco, Crane, Nibco, Milwaukee, Watts or approved equal.

i). Combination Shut-off/Balancing Valves:

Victaulic/TA Hydronics, Taco Circuit Setter, Bell & Gossett Circuit Setter Plus, Flowset Accuset, Gerand, or engineer approved equal, ½ inch-3 inches 300 psi rated globe type or ball valve with Ametal (copper-alloy) or bronze body/brass ball construction with glass and carbon filled TFE seats, in-line flow meter and balancing and shut-off valve with built in ball valve for flow adjustment. Valve shall have memory stop, calibrated nameplate, Schrader valve connections and preformed molded insulation. Valves shall be leaktight at full rated working pressure. Balance valve size shall be selected based on manufacturer's acceptable flow range and design flow rate. Pressure drop through combination shut off balance valves shall not exceed 5 feet of head at design flow rate.

j). Extended Valve Stems: Provide and install round collar type extended valve stems on all valves installed in insulated piping. Valve stem and collar shall be selected to suit insulation thickness and maintain valve handles outside of insulation.

B. Steel pipe shall be similar and equal to National Tube Company, Grinnell, Republic, or Bethlehem black or zinc-coated (galvanized) as hereinafter specified. Pipe shall be free from all defects which may affect the durability for the intended use. Each length of pipe shall be stamped with the manufacturer's name.

C. Copper pipe shall be Revere, Anaconda or Chase with approved solder fittings.

2.02. PIPE HANGERS

A. All hangers for metallic piping shall be adjustable, wrought clevis type, or adjustable malleable split ring swivel type, having rods with machine threads. Hangers shall be Grinnell Company's Figure 260 for pipe ¾-inch and larger, and Figure 65 for pipe 2-inches and smaller, or approved equal. Adjustable pipe stanchion with U-bolt shall be Grinnell Company's Figure 191. Pipe roller supports shall be Grinnell's Figure 181 or Figure 271. Exterior pipe hangers shall be galvanized or stainless steel construction. For copper piping in direct contact with the hanger, hanger construction shall be copper coated to prevent contact of dissimilar metals similar to Grinnell's Figure CT-65. Hanger spacing and rod sizes for steel and copper pipe shall not be less than the following:

NOMINAL PIPE SIZE IN	STD. STEEL PIPE	MAXIMUM SPAN FT. COPPER TUBE	MINIMUM ROD DIAMETER INCHES OF ASTM A36 STEEL THREADED RODS
3/4 & 1	6	5	3/8
1 - ½	6	8	3/8
2	8	8	3/8
2 – ½	10	9	½
3	12	10	½
4	14	12	5/8
5	14	12	5/8
6	16	14	3/4
8	18	16	7/8
10	20	18	7/8
12	20	18	7/8

B. Install hangers for cast-iron and storm water soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. PS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
6. NPS 15 (DN 375): 60 inches (1500 mm) with 1-inch (25-mm) rod.
7. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

C. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

D. Anchors, guides, and roller supports shall be installed in accordance with the contract drawings and manufacturer's recommendations to provide pipe support and control pipe movement for all piping systems. Anchors and guides shall be securely attached to the pipe support structure. Submit shop drawing for proposed pipe support structure for guides and anchors for approval of the Structural Engineer. Pipe alignment guides shall be Fig. 255 Grinnell, or as approved equal. Guides shall be sized to accommodate the pipe with insulation. Guides shall be steel factory, fabricated, with bolted two section outer cylinder and base for alignment of piping and two section guiding spider for bolting to pipe.

E. Hangers for pipe sizes ½ to 1 ½ inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.

F. Hangers for cold pipe sizes 2 inches (50 mm) and over: Carbon steel, adjustable, clevis.

G. Hangers for cold pipe sizes 2 to 4 inches (50 to 100 mm): Carbon steel, adjustable, clevis.

H. Multiple or Trapeze hangers: Steel channels with welded spacers and hanger rods.

I. Wall support for pipe sizes to 3 inches (76 mm): cast iron hook

J. Wall support for pipe sizes 4 inches (100 mm) and over: Welded steel bracket and wrought steel clamp.

K. Vertical Support: Steel riser clamp.

L. Floor support for cold pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

M. Copper pipe support: Carbon steel ring, adjustable, copper plated.

N. Hanger rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

O. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.03. VALVES

A. Provide parts list and assembly drawings (exploded view) for all valves in shop drawing submittals. Provide valves of the same type by the same manufacturer.

B. Check valves in circulator discharges shall be horizontal type.

C. Multi-purpose valve (non-slam check valve, throttling valve, shut-off valves and calibrated balancing valve) shall be provided at discharge side of each constant speed pump. The valve shall be of heavy-duty cast iron construction with standard ANSI flanged connections and rated for a maximum working pressure of 175 psig at 240°F. The valve shall be fitted with a stainless steel stem or stem sleeve and brass seat with "O" ring seal. Valve shall be Taco "Plus One" Number 300-4.2, Bell and Gossett 3DS Triple Duty Valve, Armstrong, or as approved equal, and shall have check and plug valve features plus a memory stop with pointer and scale. Provide additional shut-off valve to allow servicing of check valve if a multipurpose valve is utilized in lieu of separate check, shut-off, and balance valve. Provide additional shut-off valve downstream of multi-purpose valve to allow servicing of multi-purpose check valve feature. Provide pre-manufactured, removable insulation covers for all multipurpose valves.

2.04. STRAINERS

A. Strainers shall be of the basket or "Y" type and shall be heavy and durable, constructed of best grade gray iron with the bottoms drilled and plugged. Bodies shall have arrows clearly cast on the sides to show flow direction. Strainers shall be equipped with easily removable covers and brass sediment baskets made of brass not less than #22 gauge in thickness. Total area of basket perforations shall be not less than four times the cross section of the entering pipe. Flow shall be into basket, and then out through the perforations. Strainers shall be suitable for water or the intended fluid. Strainers 2 inches and smaller shall have threaded or solder ends, 2 inches and larger shall have flanged ends.

B. Strainer screens shall be stainless steel with perforations and shall be 1/16-inch for pipe sizes 5 inches and less, 1/8-inch (40 percent open area) perforations for pipe sizes 6-inch and greater.

C. Provide valved and capped (with chain) blowdowns in each strainer. Blowdown valves shall be Appolo 78-100/200 series or as approved equal.

D. Strainers shall be manufactured by Watts, Mueller, Armstrong, Yarway, Spirax/Sarco or as approved equal.

2.05. UNIONS, FLANGES, AND COUPLINGS

A. Unions in steel pipe 2-inches and smaller shall be malleable iron with brass inserted seats designed for a working pressure of 150 psig.

B. Unions in copper pipe 2-inches and smaller shall be sweat fittings with bronze seats designed for a working pressure of 125 psig.

C. Flanges for steel pipe over 2 inches shall be 150 psig, forged steel, slip on. Gaskets shall be 1/16 inch thick pre-formed neoprene.

D. Flanges for copper pipe over 2 inches shall be bronze. Gaskets shall be 1/16 inch thick preformed neoprene.

2.06. MANUAL AIR VENTS

A. Manual air vents shall be similar to the hereinafter specified gauge valves. Provide 1/4-inch size on ¾-inch pipe and smaller, ½ -inch size on 1-inch pipe and larger. Install at all high points of piping. Valves shall be Crane No. 88, or as approved equal, with threaded ends, bronze body, bronze or brass bonnet and bronze stem.

2.07. THERMOMETERS

A. Unless otherwise indicated, thermometers shall be ASTM E1, in a glass type, organic filled, 9-inch scale size, corrosion-resistant metal case, with "any-angle" mounting with positive locking device. Trerice Industrial Thermometers, Weksler Instruments, Ernst Gage Co., Miljoco, or approved equal. Insertion stem length shall suite the pipe size and configuration. Thermometer wells shall be brass with brass union hubs in copper and in ferrous piping. Where piping is insulated or otherwise covered, use wells with lagging extension. Where wells are installed in pipe tees at turns, increase pipe size so that well does not restrict flow. Accuracy shall be 2 percent.

B. Unless otherwise indicated, thermometer ranges shall be as follows:

1. Domestic cold water: 0 degrees F to 100 degrees F, 1 degrees F Division.
2. Domestic hot recirc. and tempered water: 30 degrees F to 240 degrees F, 2 degrees F Division.
3. Tempered Water: 30 degrees F to 100 degrees F, 2 degrees F Division.

C. Provide heat conducting compound in wells.

D. At Contractor's option, light powered thermometers may be utilized in lieu of organic filled thermometers.

2.08. PRESSURE GAUGES

A. Unless otherwise indicated, pressure gauges shall be the bronze bourdon tube type, 4-1/2-inch dial, stem mounting, cast aluminum adjustable pointer, 1 percent accuracy over middle half of scale range, 1-1/2 percent over balance: Trerice Model 600C; Weksler Instruments, Ernst Gage Co., Miljoco, or as approved equal.

B. Gauges shall have pressure, vacuum, compound, or retard ranges as required, select ranges so that the normal readings are at the approximate midpoint and maximum system pressures do not exceed full scale.

C. Furnish and install a gauge valve at each pressure gauge. Gauge valves shall be Crane Model No. 88, Needle Valve, Ernst Gage Co. FLG 200, Wexler Instrument Corp. Type BBV4, or approved equal, rated for pressure intended.

D. Gauge connections for pressure gauges, thermometers, or control instruments shall be made using tee fittings, except that gauge connections up to 1-inch size in steel may be using threaded extra heavy pipe couplings welded directly to the main, provided that the main is at least 2-inch size for 2-inch connections, 3-inch size for 3/4-inch connections, and 4-inch size for 1-inch connections. Minimum gauge connection shall be 2-inch ips.

E. Provide snubbers on all gauges. Snubbers shall be No. 872 by Trerice, RS1/RS6 by Wexler Instruments, Miljoco or as approved equal.

2.09. PIPING SPECIALTIES

A. Pressure relief valves shall be provided in the number and sizes required to relieve 110 percent of the full input to the systems. Valves shall be rated; and installed in accordance with ASME, and CSD-1 including all amendments. Pipe discharge full size to floor drain, (with union) and support discharge pipe to prevent exerting any strain on relief valve body, piping to be Type-L copper. Water safety relief valves shall be Watts Series 740, Conbraco, Series 154A, Bell and Gossett, or approved equal. Provide pressure gauge adjacent to all safety relief valves.

2.10. ESCUTCHEONS

A. Provide chromium plated escutcheons properly fitted and secured with set screws on all exposed piping which passes through walls, floors or ceilings of finished spaces.

B. All escutcheon plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface. Plastic escutcheon plates will not be accepted.

2.11. DIELECTRIC CONNECTIONS:

A. Furnish and install electrically insulated dielectric unions, waterway fittings, or flanges, as manufactured by Victaulic Company, EPCO Sales, Inc., at the following locations:

1. Where steel piping systems join copper piping.

2. Where copper tube connects to water heaters, expansion tanks, and other steel vessels.

3. Avoid the installation of steel nipples, cast iron or steel valves and specialties, or other ferrous components in predominately copper piping systems. Where such installation is necessary, isolate the component with dielectric connections. Do not mix steel pipe and copper tube in the same run of pipe or in the same section of a piping system.

2.12. SLEEVES

A. Sleeves shall be provided around all pipes through walls, floors, ceilings, partitions, roof

structure members or other building parts. Sleeves shall be standard weight galvanized iron pipe two sizes larger than the pipe or insulation so that pipe or insulation shall pass through masonry or concrete walls or floors. Provide 20 gauge galvanized steel sheet or galvanized pipe sleeves for all piping passing through frame walls.

B. Space between the pipe and sleeve shall be caulked. Escutcheon plates shall be constructed to conceal the ends of sleeves. Each trade shall be responsible for drilling existing floors and walls for necessary sleeve holes. Drilling methods and tools shall be as hereinbefore specified.

C. Sleeves through walls and floors shall be sealed with a waterproof caulking compound.

D. Firestop at sleeves that penetrate smoke barriers smoke partitions and/or rated walls/floors.

2.13. WATER PROOF PIPE PENETRATION SEALS

A. Provide and install waterproof pipe penetration seals at all pipes that enter the building below grade or through exterior wall.

B. Link seals are to be Metraflex Metraseals, Model MS, Linkseal, or approved equal, black EPDM seal material, glass reinforced plastic pressure plates, zinc plated nuts and bolts, seals are to be resistant to sunlight and ozone, pressure rated to make a hydrostatic seal of up to 20 psig and up to 40 feet of head, temperature rated from –40 degrees F to 250 degrees F.

2.14. TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.

2. Pressure rating at least equal to pipes to be joined.

3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a). Charlotte Pipe and Foundry Company.
b). Harvel Plastics, Inc.
c). Spears Manufacturing Company.

2. Description: PVC or CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket end.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a). Colonial Engineering, Inc.
b). NIBCO INC.
c). Spears Manufacturing Company.

2. Description: PVC or CPVC four-part union. Include brass threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.15. SCHRADER VALVE

A. ¼ inch Schrader valve suitable for introducing compressed air for freeze protection of piping. Valve shall be brass or stainless steel and shall be furnished with threaded cap.

B. Install ball valve for positive shut-off as detailed.

C. Install ¾" drain valves with treaded ends to allow complete drainage of water containing pipes.

PART 3. EXECUTION

3.01. GENERAL PIPING INSTALLATION REQUIREMENTS

A. All pipes shall be cut accurately to measurements established at the building, and shall be worked into place without springing or forcing, properly clearing all windows, doors and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted. All pipes shall be so installed as to permit free expansion and contraction without causing damage. All open ends of pipe lines, equipment, etc., shall be properly capped or plugged during installation to keep dirt or other foreign material out of the system. All pipes shall be run parallel with the lines of the building and as close to walls, columns and ceilings as may be practical, with proper pitch. All piping shall be arranged so as not to interfere with removal of other equipment on devices not to block access to doors, windows, manholes, or other access openings. Flanges or unions, as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment, coils, etc., and installed so that there will be no interference with the installation of the equipment, ducts, etc. All valves and specialties shall be placed to permit easy operation and access and all valves shall be regulated, packed and glands adjusted at the completion of the work before final acceptance. All piping shall be installed so as to avoid air or liquid pockets throughout the work. Ends of pipe shall be reamed so as to remove all burrs.

B. All piping shall be graded to convey entrained air to high points where automatic air vents shall be provided. The size of supply and return pipes for each piece of equipment shall in no case be smaller than the outlets in the equipment.

C. All piping shall be run to provide a minimum clearance of 2-inches between finished covering on such piping and all adjacent work. Group piping wherever practical at common

elevations.

D. All valves, strainers, caps, and other fittings shall be readily accessible.

E. Rough-in and final connections are required to all equipment and fixtures provided under this Contract.

F. Drain valves with hose connections shall be provided at low points for drainage of piping systems. Blow down valves shall be provided at the ends of all mains and branches so as to properly clean by blowing down the lines throughout in the direction of normal flow.

G. Discharge lines from all relief valves shall be piped to within 4-inches of floor and extend to floor drains wherever floors are not pitched to drains. Pitch the relief valve piping away from the relief valve to issue that no fluid can be trapped in valve discharge. Support all relief valve piping to prevent exerting strain on the relief valve body. The end of the relief valve discharge piping shall not be threaded to prevent capping or plugging.

H. All branches from water mains shall be taken from the top of the supply mains at an angle of forty-five (45) degrees above the horizontal, unless otherwise directed. Branches feeding down shall be taken from the side or bottom of the main on water mains only. All connections shall be carefully made to insure unrestricted circulation, eliminate air pockets or trapped condensate, and permit the complete drainage of the system.

I. Cutoff valves shall be provided on each branch line from the mains on all plumbing lines.

J. Shut-off valves shall be installed at the inlet and outlet of each piece of equipment to permit isolation for maintenance and repair.

K. Balancing valves shall be installed in all domestic re-circulating systems and at all pumps, and where indicated on the drawings.

L. Unions shall be installed on all bypasses, at all connections to equipment, where shown on drawings or where required to facilitate removal of equipment whether shown or not.

M. Spring clamp plates (escutcheons) shall be provided where pipes are exposed in the building and run through walls, floors, or ceilings. Plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface.

N. If the size of any piping is not clearly evident in the drawings, the Contractor shall request instructions for the Engineer as to the proper sizing. Any changes resulting from the Contractor's failure to request clarification shall be at his expense. Where pipe size discrepancies or conflicts exist in the drawings, the larger pipe size shall govern.

O. Install all valves with stem upright or horizontal, not inverted.

P. Where pipe support members are welded to structural building framing, scrape, brush clean, weld and apply one coat of zinc rich primer.

Q. Provide clearance for installation of insulation and access to valves and fittings.

R. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

S. All water containing pipes shall be routed clear of louvers to prevent freezing condition when dampers are open.

T. Provide manual air vents at top of piping systems.

U. Install Schrader valves, ball valves, and drain valve so that all piping can be drained down in winter months. Fill domestic water systems and demonstrate drain down procedure to Owner's Maintenance staff.

3.02. THERMOMETER AND PRESSURE GAGE INSTALLATION REQUIREMENTS.

A. Install thermometers and adjust vertical and tilted positions.

B. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.

1. Install with socket extending to one-third diameter of pipe.

2. Fill sockets with oil or graphite and secure caps.

C. Install pressure gages in piping tees with pressure-gage valve located on a pipe at most readable location.

D. Adjust faces of thermometer and gages to proper angle for best visibility.

E. Clean windows of thermometer and gauges and clean factory-finished surfaces. Replace cracked and broken window, and repair scratched and marred surfaces with manufacturer's touch up paint.

3.03. VALVE INSTALLATION REQUIREMENTS

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

G. Install valves as indicated, according to manufacturer's written instructions.

H. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

I. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

J. Locate valves for easy access and provide separate support where necessary.

K. Install valves in horizontal piping with stem at or above the center of the pipe.

L. Install valves in a position to allow full stem movement.

3.04. WASTE AND VENT PIPING INSTALLATION REQUIREMENTS

A. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line. All pipe when laid shall rest on the full length of the barrel and bell holes shall be dug in trench bottoms to make joints. Pipe shall not be adjusted to grade by use of block or wedges. Where rock or old foundations are encountered, trenches shall be excavated 6-inches below grade and crusher run limestone shall be used as a bedding material to support barrel of pipe.

B. As the work progresses, the interior of the sewer shall be cleared of all dirt and superfluous materials of every description.

C. Trenches shall be kept free from water until the pipe jointing material has set and pipe shall not be laid when the conditions of the trench or the weather is unsuitable for such work. At all times, when work is not in progress, all open ends of pipe and fittings shall be securely closed to the satisfaction of the Engineer, so that no trench water, earth or other substance will enter the pipe or fittings.

D. Slip joints will be permitted only in trap seals or on the inlet side of the trap. Unions on the sewer side of the trap shall be ground faced, and shall not be concealed or enclosed. Install bell and spigot pipe with bell end upstream.

E. Threaded joints shall be American Standard taper screw threads with permacel joint compound applied to the male thread. Connections between threaded pipe and cast iron pipe shall have a ring or half coupling screwed on to form a spigot end on the threaded pipe.

F. Establish invert elevations, slopes for drainage to 1/8 inch per foot. Maintain gradients.

3.05. PIPE JOINTS INSTALLATION REQUIREMENTS

A. Grooved Joints: Grooved joint shall be installed in accordance with the manufacturer’s written recommendations. Grooved ends shall be clean and free from indentations, projections, or roll marks. The gasket shall be molded and produced by the coupling

manufacturer of an elastomer suitable for the intended service. The coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. (A distributor's representative is not considered qualified to conduct the training.)

B. Soldered Joints and Copper Piping: Joints in copper piping shall conform to the following minimum standards.

1. The pipes shall be cut to a length making certain that the ends are square, using a fins hacksaw blade or tube cutter. The ends of all pipes shall be reamed and all burrs removed.

2. The outside end of the pipe and the cut end of the fitting shall be cleaned with steel wool, sand cloth, or steel wire brush. All dark spots shall be removed.

3. The flux shall be applied evenly and sparingly to the outside end of the pipe and the inside of the outer end of the fitting until all surfaces to be jointed are completely covered. The piping and fitting shall be slipped together and reworked several times to insure an even distribution of the flux.

4. The correct amount of solder per joint for each size pipe shall be used in accordance with the manufacturer's recommendations.

5. Solder joints shall be made by using a direct flame from a torch.

6. On pipe sizes larger than ¼-inch, the fittings and valves in the pipe shall be moved or tapped with a hammer when the solder starts to melt to insure an even distribution of the solder.

7. The excess solder shall be removed while it is still in the plastic state leaving a fillet around the cup of the fitting.

8. Solder joints shall be suitable for working pressure of 100 psig and for working temperature of not less than 250 degrees F. The type of solder and flux used will be submitted for approval. Type 95-5 shall be the minimum standard.

9. Lead and antimony-based solders shall not be used for potable water systems. Brazing and silver solders are acceptable.

C. Where copper piping joins steel piping, approved bronze adapters shall be used.

D. Prohibited Connections: No direct weld, soldered, or brazed connections, without unions or flanges, shall be made to valves, strainers, apparatus, or related equipment. Right and left couplings, long threads, or caulking of pipe threads or gasket joints will not be permitted.

E. Mechanical specification for mechanical joint for cast iron pressure pipe & fittings, ANSI A21.11.

F. Plastic piping solvent cement joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe handling practice of cleaners, primers, and solvent cements. Apply primer.
2. PVC Piping: Join according to ASTM D2855.
3. CPVC Piping: Join according to ASTM D284.6/D 2845M Appendix.

3.06. HANGERS AND SUPPORTS INSTALLATION REQUIREMENTS

A. General: All hangers shall be of an approved type arranged to maintain the required grading and pitching of lines to prevent vibration and to provide for expansion and contraction. Provide protection saddles between hangers and insulation on heating water insulated pipe. Saddles shall be Grinnells Figure 173/273 or approved equal. Provide approved spacers between saddles and pipe where flexible insulation is specified. Provide insulation protection shields for insulated piping without saddles. Shield shall be Grinnell Figure 167 or as approved equal.

B. Spacing: Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.

C. Vertical Lines: Shall be supported at their bases, using either a suitable hanger placed in a horizontal line near the riser, or a base type fitting set on a pedestal, foundation or support. All vertical lines extending through more than one floor level shall be supported at each floor with a riser clamp. Riser clamp shall be Grinnell Co.'s Figure 261, or approved equal. All vertical drops to pump suction elbows shall be supported by floor posts.

D. Racks and Brackets: All horizontal piping on vertical walls shall be properly supported by suitable racks securely anchored into the wall construction. Where not practical to obtain ceiling anchorage, all piping near walls shall be supported by approved brackets securely anchored into the wall construction. Washer plates (Fib. 60, 60L) and other miscellaneous attachments, fasteners, etc., shall be Grinnell or as approved equal. All exterior hanger and bracket systems in their entirety shall be galvanized.

E. Pipe Hangers and supports shall be attached to the panel point at the top chord of bar joist or at a location approved by the structural engineer.

F. Select hangers and components for loads imposed. Secure rods with double nuts.

G. Support of horizontal piping shall allow for vertical adjustment after installation of piping.

H. Support overhead piping with clevis hangers.

I. Do not support all parallel piping from the same joist. Stagger all supports in accordance with the structural engineer's recommendations.

J. Refer to structural documents for appropriate connection/attachment materials to building.

3.07. AIR VENTING INSTALLATION

A. The top of each plumbing piping system and other points as indicated or where necessary for the removal of air from the system or equipment, shall be vented using an approved type of manual air vent.

B. In addition to manual air vents at high points of system, each item of water heat transfer equipment shall be manually vented using an approved type manual air vent. All air vents shall be accessible.

3.08. SWING CONNECTION INSTALLATION REQUIREMENTS

A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

B. Connect risers and branch connections to plumbing equipment with at least four pipe fittings, including tee in riser.

C. Connect mains and branch connections to plumbing equipment with at least four pipe fittings, including tee in main.

3.09. PIPING IDENTIFICATION INSTALLATION

A. All piping shall be identified with painted background marked with the name of the service with arrows to indicate flow direction. Color code and system identification shall comply with ANSI Standards and piping identification system shall comply with ASME A13.1-81., scheme for the identification of piping systems and ASHRAE Fundamentals Handbook, latest edition.

B. Markings shall be plain block letters, stenciled on pipes, and shall be located near each branch connection, near each valve, and at least every 10 feet on straight runs of pipe. Where pipes are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such manner as to be easily legible from the floor. Pipe identification schedule shall be as follows:

OUTSIDE DIAMETER OF PIPE OR COVERING (INCHES)	LENGTH OF COLOR FIELD (INCHES)	SIZE OF LETTERS (INCHES)
½ to 1 ¼	8	½
1-½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½
Over 10	32	3 ½

3.10. VALVE IDENTIFICATION

A. <u>All</u> valves shall be tagged with a numbered tag.

B. The tags shall be made of 1-inch diameter brass tags fastened to the valve by means of brass chains. Numbers shall agree with valve numbers on diagrammatic herein before specified.

C. Provide a minimum of six (6) valve charts with valve numbers indicating valve type, size, manufacturer and service.

D. Additional valve charts shall be mounted behind glazed wooden frames and be hung in each mechanical equipment room including each air handling unit mechanical equipment room. Additional copies shall be provided in each copy of the O&M manuals.

3.11. CLEANING PIPING AND EQUIPMENT

A. All water, plumbing piping, and pumped condensate systems shall be cleaned by filling with a solution of one (1) pound of trisodium phosphate to each 50 gallons of water and circulating this solution for a period of six (6) hours during which time the system shall reach operating temperature. The systems shall then be flushed with fresh water and refilled with fresh water purged of all air.

B. All water, plumbing, and pumped condensate piping system shall be flushed clean with fresh water. See Division 22 Sections, *Plumbing Fixture* and *Plumbing Equipment* for domestic potable water cleaning and sterilization.

END OF SECTION

SECTION 22 07 01

PLUMBING INSULATION

PART 1. GENERAL

1.01. RELATED DOCUMENTS

A. This project is to be LEED certified. Refer to Division 01 Sections, including "Sustainable Design Requirements", "Construction Waste Managements", and "Commissioning Requirements" for mandatory work which may apply to all contractors, installers, and suppliers.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

3. Product data for Credit EQ 4.1: For adhesives, welding solvents and sealants applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.

1.02. REFERENCE

A. The Conditions of the Contract and other General Requirements apply to the work specified in this Section. All work under this Section shall be subject to the requirements of Division 22 Section, *Common Work Results for Plumbing*.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

1.03. DESCRIPTION

A. All piping and equipment installed under this Contract shall be covered as specified.

1.04. SCOPE

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of thermal insulation applied to all piping, equipment, and systems, in accordance with applicable project specifications and drawings, subject to the terms and conditions of the contract.

1.05. STANDARDS

A. Thermal insulation materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or use:

1. American Society for Testing of Materials Specifications:

a). ASTM C 547, “Standard Specification for Mineral Fiber Preformed Pipe Insulation”.

b). ASTM C 533, “Standard Specification for Calcium Silicate Pipe & Block Insulation”.

c). ASTM C 55, “Standard Specification for Mineral Fiber Blanket and Felt Insulation”.

d). ASTM C 585, “Recommended Practice for Inner and Outer Diameters of Rigid Pipe Insulation for Nominal Sizes of Pipe and Tubing (NPS System)”.

e). ASTM C 612, “Standard Specification for Mineral Fiber Block and Board Thermal Insulation”.

f). ASTM C 1136, “Standard Specification for Barrier Material, Vapor, “Type 1 or 2 (Jacket only).

g). ASHRAE 90.1 “Energy efficient design of new buildings except low-rise residential buildings”, latest edition.

B. Insulation materials, including all weather and vapor barrier materials, closures, hangers, supports, fitting covers, and other accessories, shall be furnished and installed in strict accordance with project drawings, plans, and specifications.

1.06. SYSTEM PERFORMANCE

A. Insulation materials furnished and installed hereunder should meet the minimum economic insulation thickness requirements of the North American Insulation Manufacturers’ Association (NAIMA) (formerly known as TIMA), to ensure cost-effective energy conservation performance. Alternatively, materials should meet the minimum thickness requirements of National Voluntary Consensus Standard 90.1, (latest edition) and “Energy Efficient Design of New Buildings,” of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), latest edition. However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor. As minimum, all insulation thicknesses shall be as hereinafter specified.

B. Insulation materials furnished and installed hereunder shall meet the fire hazard requirements of any one of the following specifications:

1. American Society for Testing of Materials ASTM E 84

2. Underwriters' Laboratories, Inc. UL 723

3. National Fire Protection Association NFPA 255

C. Calcium silicate products shall include a visual identification system to permit positive field determination of their asbestos-free characteristics.

1.07. QUALITY ASSURANCE

A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications listed in Section 1.4 above.

B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

1.08. DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The Contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The Contractor shall also use all means necessary to protect work and materials installed by other trades.

C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the Contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer in writing for technical assistance.

D. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements. Protect all insulation from water, construction traffic, dirt, chemical and mechanical damage.

1.09. ALTERNATES

A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

1.010. LEED REQUIREMENTS

A. Refer to Division 01 Section LEED Requirements for description of work under this Division affected by LEED requirements.

PART 2. PRODUCTS

2.01. GENERAL

A. All materials to be insulated shall be thoroughly cleaned, after completion of successful tests, and shall be covered as specified below. Fiberglass insulation shall be Owens-Corning, Manville, Armstrong, or P.P.G, or as approved equal.

2.02. PIPE INSULATION MATERIALS

A. Unless otherwise noted, insulation shall be one piece or half sectional molded fibrous glass with "K" rating of .23 at 75 degrees F mean temperature, for service temperatures between -60 degrees F and +450 degrees F with all service jacket. Pipe insulation shall be fiberglass SSL II with double closure system as manufactured by Owens Corning, Johns Manville, Knauf or approved equal.

B. Unless otherwise noted, pipe insulation jacket shall be factory-applied vinyl coated, embossed and reinforced vapor barrier laminate, with a perm rating of not more than 0.02 perms. All hot and cold, concealed and exposed butt strips shall be of the same material as the jacket. Jacket and butt strips shall be sealed with field-applied Benjamin Foster adhesive. Jacket and butt strips shall be off-white color and shall be equivalent to Owens-Corning Fiberglass 25-ASJ.

C. For fittings on all piping, valves and flanges, apply fiberglass molded or segmented insulation equal in thickness to the adjoining insulation and securely fasten in place using wire. Apply a skin coat of insulating cement to produce a smooth surface. After cement is dry, apply a light coat of fitting mastic, UL labeled, Type C, for cold water piping, and Type H for hot water piping. Wrap fitting with fiberglass reinforcing cloth overlapping adjoining sections of pipe insulation by 2-inches. Apply a second coat of Type C or Type H mastic over the reinforcing cloth, working it to a smooth finish. As an option to the above fittings, a polyvinyl chloride fitting cover may be supplied.

D. All pipe insulation, jackets, or facings, and adhesives used to adhere jacket or facing to the insulation, including fittings and butt strips, shall have non-combustible fire and smoke hazard system rating and label as tested by ASTM E-84, NFPA 225, and UL 73, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50. Accessories such as adhesives, mastic cements, tapes and cloth for fittings shall have the same ratings as listed above. All products or their shipping cartons shall bear the Underwriter's label indicating that flame and smoke ratings do not exceed the above criteria.

E. On cold systems such as domestic cold water, rainleaders, vapor barrier performance is extremely important. All penetrations of the ASJ and exposed ends of insulation must be sealed with vapor barrier mastic. The ASJ must be protected with either a mastic coating or a suitable vapor retarding outer jacket. Vapor seals at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion.

F. Fittings and valves shall be insulated with pre-formed fiberglass fittings, fabricated sections of Fiberglass pipe insulation, Fiberglass pipe and tank insulation, Fiberglass blanket insulation, or insulating cement. Thickness shall be equal to adjacent pipe insulation. Finish

shall be with pre-formed PVC fitting covers or as otherwise specified on contract drawings. Where applicable, Victaulic PVC fitting valve and coupling covers shall be utilized. Victaulic PVC covers shall be installed with matching pipe insulation jacketing material, vinyl tape, solvent weld adhesive and appropriate fasteners.

1. Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with a suitable weather or vapor-resistant mastic as dictated by the system location and service. Finish valve installation with a Tyvac jacket with ends that secure to adjacent piping.

2. On hot systems where fittings are to be left exposed, insulation ends should be beveled away from bolts for easy access.

3. On cold systems, particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. All valve stems must be sealed with caulking which allows free movement of the stem but provides a seal against moisture incursion. All gauge and thermometer penetrations and extensions shall be correctly sealed and insulated to prevent surface condensation.

G. All piping shall be supported in such a manner that neither the insulation or the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing must be such that the circumferential joint may be made outside the hanger. On cold systems, vapor barrier must be continuous, including material covered by the hanger saddle.

1. Piping systems 3-inches (7.5cm) in diameter or less, insulated with Fiberglass insulation, may be supported by placing saddles of the proper length and spacing, as designated in Owens-Corning Pub. 1-IN-12534, under the insulation. Hangers saddles shall be minimum 16 gauge with a saddle arc of 120 degrees minimum.

2. For hot or cold piping systems larger than 3-inches (7.5 cm) in diameter, operating at temperatures less than +200 degrees F (93 degrees C) and insulated with fiber glass, high density inserts such as foam with sufficient compressive strength shall be used to support the weight of the piping system. At temperatures exceeding $\pm$200 degrees F (93 degrees C), Owens-Corning Pink Calcium Silicate pipe insulation shall be used for high density inserts.

3. Owens-Corning Pink Calcium Silicate pipe insulation may be used to support the entire weight of the piping system provided the hanger saddle is designed so the maximum compressive load does not exceed 100 psi (7kg/cm).

4. Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.

5. Thermal expansion and contraction of the piping and insulation system shall generally be taken care of by utilizing double layers of insulation and staggering both longitudinal and circumferential joints. Where long runs are encountered, expansion joints may be required where single layers of insulation are being used and should be so noted on the contract drawings.

6. On vertical runs, insulation support rings shall be used.

2.03. PIPING INSULATION THICKNESSES SCHEDULE

A. All piping shall be insulated with pipe insulation of the thicknesses indicted below:

PIPING INSULATION THICKNESS SCHEDULE SERVICES	**THICKNESS**
All Horizontal Roof Drain Piping Including Sumps	1-inch thickness
All Drain Piping from Cooling Coils/Evaporators	½-inch thickness
All Domestic Hot and Cold Water Piping, including Re-circulating Piping	1-inch thickness
Heat Traced Domestic Water Piping 2-inches and smaller	1 ½ -inch thickness
Above Grade Trap Priming Lines	½ -inch thickness
Electric Water Cooler Drains	1-inch thickness

2.04. EQUIPMENT INSULATION MATERIALS AND THICKNESSES

A. The following equipment shall be insulated with Fiberglass Rigid Board Insulation or Foam Plastic Insulation:

1. Expansion Tanks.

2. Domestic Water Meters.

3. Backflow Preventer Valve Bodies.

4. Plumbing Pumps.

5. All Pump Volutes and Strainers.

B. Insulation for cold surfaces shall be 1-1/2-inch thickness, 6 lb. density, 705 FRK with a "K" rating of .23 at 75 degrees F mean temperature. Insulation for hot surfaces except as otherwise noted shall be 1-1/2-inch thickness, 6 lb. density, 705 with a "K" rating of .23 at 75 degrees F mean temperature. Insulation shall be applied with staggered joints firmly butted and joined. The insulation shall be held in place by steel bands. Bands shall be 1-inch by 25 gauge galvanized steel spaced on not over 12-inch centers. All joints and voids shall be filled with Owens-Corning #110 cement, well troweled into openings. For 705 FRK insulation, all joints and voids shall be FRK taped and vapor sealed. There shall be applied

over the insulation surface 1-inch galvanized wire netting laced together at all edges and wired to the steel bands with 16 gauge soft annealed wire. Over this shall be applied 2-inch thick layer of Owens-Corning #110 cement applied in two layers. Install metal corner beads at all corners and edges in order to provide a permanent installation. Onto the dry cement surface apply a brush coat of Foster Sealfas 30-36 at the rate of 60-70 square feet per gallon. Embed into wet coating a layer of 8 ounce canvas smoothed out to avoid wrinkles and lap all seams a minimum of 2-inches. Apply a second brush coat of Sealfas 30-36 to the entire surface at the rate of 60-70 square feet per gallon. Cleanouts, nameplates, and manholes shall not be insulated, and the insulation on surrounding surfaces shall be neatly beveled off at such openings.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch (150-mm) centers, starting at corners. Install 3/8-inch- (10-mm-) diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.

2. Fabricate boxes from aluminum at least 0.040 inch (1.0 mm) thick.

3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

D. Mechanical fasteners shall be utilized to hold insulation to surface with bands as required to hold the curvature of the material.

E. Support rings shall be provided to support the top head insulation where required.

F. Outdoor installations require a weather barrier for protection of the insulation jacketing.

G. Insulation types materials shall be suitable for temperatures encountered by each item of equipment.

2.05. ACCESSORY MATERIALS

A. Accessory materials installed as part of insulation work under this section shall include, but not be limited to:

1. Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives; pressure-sensitive tapes.

2. Field-applied jacketing materials - sheet metal, plastic, canvas, fiber glass cloth, insulating cement; PVC fitting covers, PVC jacketing.

3. Support Materials - Hanger straps, hanger rods, saddles.

4. Fasteners, weld pins/studs, speed clips, insulation washers.

5. Metal mesh or expanded metal lagging.

B. All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards."

2.06. FIELD-APPLIED JACKET

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a). Johns Manville; Zeston.
   b). P.I.C. Plastics, Inc.; FG Series.
   c). Proto PVC Corporation; LoSmoke.
   d). Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer. VOC content not to exceed 250 g/L.

3. Color: High Gloss White

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a). Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

PART 3. EXECUTION

3.01. WORKMANSHIP

A. The Contractor shall take special care to prevent soiling equipment below or adjacent to areas being insulated. He shall be completely responsible for removing insulation cement splashes and smears and all surfaces that he mars or otherwise soils or defaces, and he will be totally responsible for restoring these damaged surfaces to their like-new condition when delivered to the site.

3.02. SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.03. PREPARATION

A. Ensure that all pipe and equipment surfaces over which insulation is to be installed are clean and dry.

B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

C. Ensure that pressure testing of piping systems has been completed prior to installing insulation.

3.04. INSTALLATION

A. Piping Systems

1. General:

a). Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.

b). Install insulation on piping subsequent to installation of heat tracing, painting, testing, and acceptance tests.

c). Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.

d). Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tear or other damage. Seal all tears, punctures and other penetrations of the pipe insulation vapor barrier facing.

e). On exposed piping, locate insulation and cover seams in least visible location.

2. Fittings: Cover valves, fittings, unions, flanges, strainers, flexible connections, expansion joints, pump bodies, strainers, blowdowns, backflow preventers, autoflow valves and similar items in each piping system using one of the following:

a). Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.

b). Insulation cement equal in thickness to the adjoining insulation.

c). PVC fitting covers insulated with material equal in thickness and composition to adjoining insulation.

3. Penetrations: Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise specified.

4. Joints:

a). Butt pipe insulation against hanger inserts. For hot pipes, apply 3-inch (7.5cm) wide vapor barrier tape or bank over butt joints. For cold piping, apply wet coat of vapor barrier lap cement on butt joints, and seal joints with 3-inch (7.5cm) wide vapor barrier tape or band.

b). All pipe insulation ends shall be tapered and sealed, regardless of service.

5. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

B. Equipment Insulation:

1. General:

a). Install insulation in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.

b). Install insulation on equipment after installation of heat tracing, painting, testing, and acceptance tests.

c). Install insulation materials with smooth, even surfaces. Rework poorly fitted joints. Do not use joint sealer or mastic as filler for joint gaps and excessive voids resulting from poor workmanship. Apply insulation using staggered joint method for both single and double layer installation, applying each layer of insulation separately.

d). Coat insulated surfaces where specified on contract drawings with layer of insulating cement, troweled in a workmanlike manner, leaving a smooth and continuous surface. Fill in seams, broken edges, and depressions. Cover over wire mesh and joints with cement sufficiently thick to remove surface irregularities.

e). Maintain the integrity of factory-applied vapor barrier jacketing on all insulation, protecting it against puncture, tears or other damage. Seal all tears, punctures and other penetrations of equipment insulation facing.

f). Where specification calls for field-applied all-service vapor barrier jacketing, it shall be neatly fitted and tightly secured. Lap seams 2-inches (5cm) (min.). Seal all joints with adhesive. Tape with 3-inches (7.5cm) matching pressure-sensitive tape or 3-inch (7.5cm) glass fabric and mastic.

g). On exposed equipment, locate insulation and cover seams in least visible location.

2. Removable Insulation: Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance, such as vessel covers, fasteners, flanges, frames accessories, manholes, handholes, cleanouts ASME stamp, and manufacturer nameplates.

3. Areas Left Uninsulated: Items such as manholes, handholes, clean-outs, ASME stamp, and manufacturers' nameplates should be left uninsulated unless omitting insulation would cause a condensation problem. When such is the case, provide removable insulation and appropriate tagging to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

4. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather barrier mastic protective finish or jacketing as recommended by the jacketing manufacturer.

3.05. FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.06. PROTECTION

A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.07. SAFETY PRECAUTIONS

A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.

B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.08. INSULATION COVERING

A. Unless otherwise noted, all exposed equipment insulation shall have a field applied PVC jacket cover neatly cut and pasted over equipment insulation. PVC shall be high gloss white and shall be 20 mils thick. Exposed areas include, but are not limited to, all mechanical equipment rooms, janitor's closets, utility rooms, electric rooms, and piping and ductwork exposed in an occupied space.

B. Unless otherwise noted, all exposed pipe insulation required to be insulated shall be jacketed with a PVC Jacketing with fitting covers. PVC jacket shall be color fade resistant, white high gloss, U.S.D.A. authorized as manufactured by Proto Corporation or approved equal. PVC jacketing shall be high impact, ultraviolet resistant PVC. Minimum thickness shall be 20 mils, roll stock ready for shop or field cutting and forming.

C. Where PVC jackets are indicated, install with 1 inch overlap at longitudinal seams and end joints, for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

END OF SECTION

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for combined water service and fire-service mains.

B. Contractor shall furnish and install all mains, hydrants, valves and fittings as specified and indicated on the drawings.

C. All water and wastewater utility construction and materials to be dedicated to the City shall be performed by a contractor approved by the city and to the standards and specifications issued by the city. This includes review and approval by the City of shop drawings and materials. Comply with the *City of Dover Water and Wastewater Handbook.*

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for water system piping.

1. Underground Piping: 150 psi (1035 kPa).
2. Underground Piping, Fire Suppression System: 200 psig (1380 kPa).

B. Protection of Potable Water Supply:

1. A minimum of 10 feet horizontal separation shall be provided between proposed water mains and proposed sewers.
2. Clearances: Where specified crossing clearance cannot be obtained, sewer shall be encased in concrete for 10 feet each side of water main. For crossings of other utilities, sewer shall be encased with limits of the utility trench.

    a. Sewer crossing water mains shall have a clearance of 18 inches below water main or shall be encased.
    b. Sewers shall have a minimum of 6 inches clearance when crossing other utilities.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

E. Record drawings at Project closeout of installed water system piping and products according to Division 1 Section "Project Closeout."

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with AWWA C151 for selection, design, and installation of ductile iron water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. NSF Compliance:

1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

G. Provide listing/approval stamp, label, or other marking on equipment made to specified standards

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Construction Manager Owner & Municipality no fewer than five days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Construction Manager's & Municipality’s written permission.

B. Verify that water system piping may be installed in compliance with original design and referenced standards.

C. Site Information: Reports on subsurface condition investigations made during the design of the Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions (between soil borings). Owner and Architect assumes no responsibility for interpretations or conclusions drawn from this information

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

B. Coordinate connection to Building Plumbing and other Division 22 work.

C. Coordinate with other utility work including but not limited to fire protection systems piping.

D. Coordinate electrical requirements of actual equipment furnished with requirements specified in Division 26.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.

B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Push-on-Joint, Ductile-Iron Pipe: Class 52, AWWA C151, cement lined with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.
3. Standard joint length shall be 18’-20’.

B. Mechanical-Joint, Ductile-Iron Pipe: Class 52, AWWA C151, cement lined with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
3. Standard joint length shall be 18’-20’.

C. Flanges: ASME 16.1, Class 125, cast iron.

D. Comply with NFPA 24 and local/state regulations for fire-service mains.

2.3 PVC PIPE AND FITTINGS

A. PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket, and with spigot end.

B. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

C. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. PVC pipe only used on 4” or smaller lines.

2.4 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Split-Sleeve Pipe Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Victaulic Depend-O-Lok.

2. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

a. Standard: AWWA C219.
b. Sleeve Material: Stainless steel.
c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
e. Pressure Rating: 200 psig minimum.
f. Metal Component Finish: Corrosion-resistant coating or material.

C. Flexible Connectors:

1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

D. Tracer wire:

1. Minimum 12 gauge blue coated solid copper wire.

E. Retaining Glands

1. High strength ductile iron conforming to ASTM A536, Grade 65-45-12.
2. Wedging mechanism of heat treated ductile iron with 370 BHN hardness
3. Glands shall be per ANS1/AWWA A21.11/C111 and ANSI AWWA A21.53/C153.
4. Minimum working pressure rating to be 350 psi.

2.5 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Provide valves by Mueller, Model 2360 or a comparable product approved by the Municipality/Utility.

2. Nonrising-Stem, Resilient-wedge epoxy coated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig .
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Manufacturers: Subject to compliance with requirements of the municipality/utility, provide products by one of the following:
2. Provide Powerseal 3490AS or a comparable product approved by the utility.
3. Description: Sleeve and valve compatible with drilling machine.

a. Standard: AWWA C115.
b. Tapping Sleeve: Stainless-steel type 304 (18-8), two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with stainless flange for branch valve.
c. Bolts & Nuts: type 304 (18-8) stainless per ASTM A193 and A194.

4. Valve: AWWA C509 epoxy coated, resilient wedge, NSF 61 certified. cast-iron, nonrising-stem, with one raised face flange mating tapping-sleeve flange. Mueller A-2360T or equal approved by Municipality.

B. Valve Boxes: Cast iron three piece screw type box. Provide Tyler Union 6860 series. Include top section, extra deep lid with two holes, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel 5 1/4 inches in diameter.

1. Provide boxes by Tyler, or a comparable product approved by the utility.
2. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
3. All boxes for 4, 6, and 8-inch valves shall be equipped with #6 round base. 10-inch valves shall be used with #8 valve box base. Valve boxes shall be adjustable between 2’-4” and 3’-4” except when deeper settings are required.

2.7 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Mueller Co. Water Products Division; model number per utility company standard for service line size.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet with outlet matching service piping material.
2. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 4 1/4 inches in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2. Provide Tyler Union 6500 or approved equal by City.

2.8 WATER METERS (1 ½”) AND PIT

A. Water meter will be purchased from the Municipality/utility company within the base bid.

B. Meter to be 1 ½” Sensus Omni T2 with Itron ERT.

C. Contractor to install meter with pit and appurtenances.

D. Meter pit to be Mueller/Hunt EZ-vault meter setter with angle valve at meter entrance and Mueller H-14460-A dual check valve at meter outlet.

2.9 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide the following:

a. Darling Co. B-62-B Breakaway

2. Description: Freestanding, with one NPS 41/4 and two NPS 2-1/2 outlets, Threads shall match those presently used in the Utilities system, nozzles shall be connected to the upper barrel by means of a quarter turn system and held in place with a 304 stainless steel screw, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a. Standard: AWWA C502.
b. All hydrants to be furnished with non-kinking chains on the 2 ½-inch nozzles.
c. Caps and operating nut shall have the “DOVER SPECIAL” taper.

3. A sworn certificate of inspection and testing shall be furnished by the manufacturer. Install hydrants with restraint system as detailed on the drawings, or with a hydrant tee.

2.10 CONCRETE METER VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858. Dimensions of vault shall be to provide required clearance per City’s Water/Wastewater handbook.

1. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.
2. Manhole: ASTM A 48/A 48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.

a. Dimension: 24-inch minimum diameter, unless otherwise indicated.

3. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.

a. Dimension: 24-inch- minimum diameter, unless otherwise indicated.

2.11 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

1. Manufacturers: Subject to compliance with requirements of the DE State Fire Marshal and local health department and match local fire department threads.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall contact the City of Dover Public Utilities Construction & Inspections Manager at (302) 736-7070 prior to start of construction.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground Combined Water-Service and Fire-Service-service piping shall be any of the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
2. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products
3. Installation shall be coordinated with and overseen by the fire protection contractor.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults as indicated in utility company details. Use UL/FMG, non-rising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
2. Use the following for valves in vaults and aboveground:

   a. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.

3. Relief Valves: Use for water-service piping in vaults and aboveground.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated except where deviations to layout are approved on coordination drawings.

B. Install piping at indicated slope.

C. Install restrained joints for buried piping within 5 feet (1.5m) of building. Use restrained-joint pipe and fittings, thrust blocks, anchors, tie-rods and clamps, and other supports at vertical and horizontal offsets.

D. Install piping free of sags and bends.

E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

F. Install fittings for changes in direction and branch connections.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G. Bury piping with depth of cover over top at least 48 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

H. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

I. Each section of pipe shall be placed on a solid foundation for its full length, with recesses excavated to accommodate the bell of the pipe. Any pipe which has its grade or joint disturbed after installation shall be removed and reinstalled. No pipe shall be installed on frozen or wet subgrade. Bedding material shall be provided per the City of Dover Water/Wastewater Handbook DWG WW-16.

J. The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench or weather conditions are unsuitable for such work.

K. At all times work is not in progress, all open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipe or fittings.

L. Any section of pipe in place and found to be defective shall be removed and replaced immediately at no cost to the Owner.

M. No section of pipe shall be installed with deflection greater than manufacturer's recommendations either vertically or horizontally. Any deviation required to be greater than recommended shall be made with a special fitting.

N. All installation of ductile iron pipe shall be in accordance with AWWA Standard No. C600 with tracer wire and detector tape.

O. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping to within 5, of building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

P. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

Q. See Division 21 Section "Water-Based Fire-Suppression Systems" for fire-suppression-water piping inside the building.

R. See Division 22 Section "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Set-screw mechanical retainer glands.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
2. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE & VALVE BOX INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

C. Valve boxes shall be installed at each outside valve. Boxes shall be sufficient length to provide a cover of not less than two feet over the pipe. Valve boxes shall be set plumb, and placed directly over the valve. Valve boxes shall be placed on two, 4-inch solid concrete blocks. After being correctly positioned, each fill shall be carefully tamped around the valve box for a distance of four (4) feet on all sides of the box. Any box found out of plumb or settled shall be reset at no cost to the Owner.

3.9 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

3.10 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.11 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant as required by the Municipality/utility company per detail. Provide with separate gate valve in supply pipe, anchor If no detail provided, use restrained joints or thrust blocks. Support hydrant in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17.

C. Hydrant leads shall be ductile iron.

3.12 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

B. Install protective pipe bollards as required by local fire marshal at each fire department connection. Pipe bollards are specified in Division 05 Section "Metal Fabrications."

3.13 FIELD QUALITY CONTROL

A. Piping Tests: The Contractor shall furnish all equipment, labor, and materials, including water, pumps, compressors, stopwatch, gauges, and meters for testing. The Municipality shall determine the amount of main to be tested at any one time and reserves the right to separate the installation into several test sections. All tests must be witnessed by the Construction Manager or Owner.

B. Domestic Water Main Hydrostatic Tests: Test at not less than 165 psi, whichever is greater, for two hours.

1. Test Pressure shall:

a. Be not less than 165 psi for water mains and not less than 200 psi for fire mains.

b. Be of at least two hour duration
c. Result in no variation

2. Pressurization:

a. Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under the test and corrected to the elevation of the test gauge shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner.

3. Air Removal:

a. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points, so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, all corporation cocks shall be removed and plugged, or left in place at the discretion of the Owner.

4. Examination:

a. All exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with same material and the test shall be repeated until it is satisfactory to the Owner.

C. Prepare reports of testing activities.

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by Municipality/utility company and authorities having jurisdiction including the Delaware Department of Health. Procedure shall be as described in AWWA C652.
3. If method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C652 or do as follows:

a. Upon completion of water main construction, disinfect main and appurtenances. Disinfection shall be done in accordance with ANSI/AWWA C-651, latest edition. Contractor shall submit a plan of disinfection for approval by the Architect.

b. After the applicable retention period, the heavily chlorinated water shall be flushed from the main. This water shall be discharged to the sanitary sewer system. Only after water leaving the main is no higher in chlorine concentration than normal drinking water, will a discharge to storm drains be allowed. Convey flushed water to discharge point in a closed system.

c. Affidavits of compliance, certifying the water sampled from the water mains to be free of coliform bacteria, shall be submitted to the Architect. The Contractor is responsible for requesting tests from the Delaware Department of Public Health. He shall provide written documentation when a section of mains can be placed in service.

d. The Contractor shall place in each length of pipe, hydrants, hydrant branches, and other appurtenances, a sufficient amount of HTH tablets to insure adequate disinfection treatment of the main after its completion. Tablets shall be fastened to the inside top of every length of pipe as laid, using gasket cement known as “Permatex No. 2”.

e. The Contractor will be held entirely responsible for securing a minimum residual chlorine content of 5 p.p.m. at the extremities of the mains after twenty-four (24) hours or more contact with the full water pressure on the main.

f. Water for filling the mains shall be introduced at a velocity of less than one (1) foot per second in order to permit the HTH or Perchloron to completely dissolve and have a reasonable uniform distribution throughout the mains. It is the intent of this Specification to require a sufficient amount of chemical to be equivalent to a dosage of 50 p.p.m. of chlorine.

g. After the chlorine has been in contact with the mains or storage units for twenty-four (24) hours or longer, samples collected from the extremities of the mains shall indicate a residual chlorine content of 5 p.p.m. or more.

h. If less than 5 p.p.m. residual chlorine is indicated, the system shall be drained and the disinfection treatment repeated.

i. If samples collected at the extremities indicate a residual chlorine of 5 p.p.m. or more, the system shall be flushed until there is only a normal chlorine residual (1.0 p.p.m. or less) present, as determined by the DPD Method Test. Samples of water shall be collected from various points along the lines, by a lab certified in the State of Delaware for bacteriological analysis. If satisfactory bacteriological results are obtained, the lines may then be allowed to be placed in service. A copy of all test results shall be submitted to the Architect.

4. Contractor shall provide all disinfection testing within the lump sum prices bid.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 221313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes gravity-flow, non-pressure sanitary sewerage outside the building, with the following components:

1. Special fittings for expansion and deflection.
2. Cleanouts.
3. Precast concrete manholes.
4. Pipe

B. All water and wastewater utility construction and materials to be dedicated to the City shall be performed by a contractor approved by the city and to the standards and specifications issued by the city. This includes review and approval by the City of shop drawings and materials. Comply with the *City of Dover Water and Wastewater Handbook.*

1.3 SUBMITTALS

A. Product Data: For the following:

1. Special pipe fittings.
2. Bedding materials

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers.
2. Pipe and fittings
3. All shop drawings will require review and approval by the City of Dover.

C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.

B. Utility Compliance: Comply with local Municipality/utility company regulations and standards pertaining to sanitary sewer systems.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager & Municipality no fewer than five days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's & Municipality's written permission.

B. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that sewerage system piping may be installed in compliance with original design and referenced standards.

1. Locate existing sanitary sewerage system piping and structures that are to be abandoned and closed.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 GRAVITY PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals. Pipe stiffness, as tested in accordance with ASTM-D-2412, shall be 45 when measured under 5% deflection at 73° Fahrenheit. Pipe shall be manufactured with integral wall bell and spigot joints in standard lengths not exceeding 20.0 feet.

B. Corrugated PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 949-93a, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

C. Polyvinyl chloride wye branches, pipe stoppers and other fittings shall be manufactured in accordance with the same specifications and shall have the same thickness, depth of socket, and annular space as the pipe. Tee fittings will not be permitted for use. Wye branches shall be complete pipe sections. Saddles will not be permitted for use.

D. Polyvinyl chloride pipe shall be delivered and stockpiled in unit pallets. Stacking of pallets above five (5) feet in height will not be allowed. If pipe is stockpiled for more than thirty (30) days prior to installation in the trench, it must be suitably covered with reflective material to protect the pipe from ultraviolet rays emanating from sunlight. Do not use plastic sheets. Allow for air circulation under covering.

E. Bowed sections of pipe will be unacceptable and installation of pipe which has bowed, whether or not the bow has been corrected, will not be allowed.

F. Couplings: Rubber or elastomeric sleeve and stainless steel band assembly fabricated to match outside diameters of pipes to be joined.

1. Sleeves: ASTM C 564, rubber for cast-iron soil pipe; and ASTM F 477, elastomeric seal for plastic pipe. Sleeves for dissimilar or other pipe materials shall be compatible with pipe materials being joined.

2. Bands: Stainless steel, one at each pipe insert.

2.3 CLEANOUTS

A. Wye & Riser: Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

B. Cover: Geneco Style H or approved equal.

2.4 MANHOLES

A. General

1. Manholes shall be State of Delaware Department of Transportation certified.
2. Manholes shall be built at such points on the pipelines, and of such form and dimensions as are shown on the drawings or as may be directed. Manholes shall be built as pipe laying progresses, and the Project Civil Engineer may stop work entirely on the pipe laying, if manhole construction is delayed to such an extent as to be hazardous to construction or the public.
3. Manholes shall be spaced no more than 400 feet apart and at all bends in gravity sewer mains.

B. Precast Concrete Manholes: ASTM C 478, precast reinforced concrete, of depth indicated with provision for rubber gasket joints.

1. Precast reinforced concrete risers, eccentric cones and bases shall be in conformance with ASTM Designation C 478. Joints between riser sections shall be fitted with an “O” ring rubber gasket, meeting the requirements of ASTM Designation C 443. Installation of risers shall be in accordance with manufacturer’s recommendations under the supervision of the Architect.
2. Precast reinforced concrete base and riser sections shall be as manufactured by Atlantic Concrete Products Company, Virginia Precast Corporation, or equal.
3. Interior and exterior joint spaces of all manhole risers shall be filled prior to application of the exterior waterproofing. The interior joint shall be mortared. The exterior joint may be mortared or filled with a joint filler compound. Said compound shall be Pioneer 301 as manufactured by Daubert Chemical Company, Oakbrook, Illinois, or equal.
4. Lifting holes in the walls of precast reinforced concrete risers will be allowed but shall be plugged with rubber stoppers and grouted flush with face or manhole wall after installation of manhole riser sections. Not more than two (2) holes shall be cast in the walls of each riser section for the purpose of handling.
5. The exterior surface of all precast manholes shall receive a minimum two (2) coat application of a 68% solids coal tar type protective coating. The total average dry film thickness shall measure 24 mils with no single measurement to be less than 20 mils. Surface shall be prepared in accordance with the manufacturer’s instructions and coatings applied in the field in a manner acceptable to the Project Civil Engineer. The coating material shall be Bitumastic Super Service Black manufactured by Koopers Company, Inc., Pittsburgh, Pennsylvania, Tar Jet Super Black XX-32-B-22 manufactured by Pennsbury Coatings Corp., New Britain, Pennsylvania, or equal.
6. All pipe-to-manhole connections in the precast manhole shall be made by means of an integrally cast flexible connector which shall be Lockjoint flexible manhole sleeve as manufactured by Interpace Corp., Parsippany, New Jersey, or A-Lok flexible manhole gasket as manufactured by A-Lok Corp., Trenton, New Jersey, or equal.
7. Channel and Bench: Concrete or Brick. If brick, comply with City of Dover stand specifications and details.

C. Manhole Steps: Wide enough for a man to place both feet on one step and designed to prevent lateral slippage off the step.

1. Material: Manhole steps shall be made of 3/8-inch diameter (No. 3) steel reinforcing bars, ASTM Designation A 615, Grade 60, encased in polypropylene plastic. Manhole steps shall have notched tread ridge with retainer lug on each side.
2. Manhole steps shall be cast in place during manufacture of precast reinforced concrete manholes or placed in brick manholes during construction. Embedment length shall be suitable for minimum five (5)-inch thick, precast reinforced concrete riser walls.
3. Manhole steps shall be OSHA approved and as manufactured by; M.A. Industries, Inc., Peachtree City, Georgia; ICM, Inc., Jacksonville, Arkansas, or equal.
4. Manhole steps shall be spaced twelve (12)-inches apart. The maximum spacing from top of manhole to the first step shall not exceed sixteen (16)-inches.

D. Manhole Frames and Covers:

1. Frames and covers shall be East Jordan Iron Works #NCR08-1856F1 or approved equal. They shall be heavy duty, hinged with machined seats, inner cover and bronze lock lugs. Material for frames and covers shall be in accordance with standard specifications for gray iron castings ASTM A-536 for Class 30.
2. Frames and covers for manholes shall be set by the Contractor as the work progresses. The frame shall be well bedded in mortar.
3. The maximum allowable vertical adjustment of manhole cover frames shall be 12 inches. Adjustments shall be made with brick and mortar or precast adjustment rings may not be used.
4. Covers shall be marked “CITY OF DOVER”.

E. TESTS

1. If inspection reveals any visible leakage or seepage in any manhole, the Contractor will be required to accomplish such remedial measures as may be directed by the Project Civil Engineer. Caulking or patching of interior manhole surfaces will not be acceptance.

2.5 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 3000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

   a. Invert Slope: Match pipe slope through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 4 percent.

2.6 IDENTIFICATION

A. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letters "CAUTION - SEWER LINE BURIED BELOW."

B. Tracer wire:

1. Minimum 12 gauge green coated solid copper wire.

C. MODIFIED EPOXY COATING

1. Tnemec Series 435 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall contact the City of Dover Public Utilities Construction & Inspections Manager at (302) 736-7070 prior to start of construction.

3.2 PREPARATION OF FOUNDATION FOR BURIED SANITARY SEWERAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which bedding and pipes are to be laid, and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of pipe. Bottom of Trench to include a continuous and uniform bedding of #57 stone with a minimum depth according to City of Dover Water/Wastewater Handbook DWGs WW-16 & WW-17. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 INSTALLATION, GENERAL (GRAVITY)

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground sanitary sewerage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope of 2 percent, except where indicated otherwise.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated.

G. Install 1-inch-thick extruded polystyrene over underground building drain piping not under building. Width of insulation shall extend minimum of 12 inches beyond each side of pipe. Install directly over and center on pipe center line.

H. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.

I. Manhole stubs shall be extended four (4) feet outside of the manhole wall, unless otherwise detailed. The stub end shall be plugged.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION (GRAVITY)

A. Join and install hub and spigot cast-iron soil pipe and fittings with compression gaskets in accordance with CISPI "Cast Iron Soil Pipe and Fittings Handbook, Volume I." Use "Extra Heavy" class gaskets to match class of pipe and fittings.

B. Join and install PVC pipe as follows:

1. Pipe and gasketed fittings, joining with elastomeric seals in accordance with ASTM D 3212. Bell and spigot pipe.
2. Installation in accordance with ASTM D 2321.

C. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.5 MANHOLES

A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channels and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 3 inches above finish surface, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated, and install in accordance with ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

E. Apply bituminous mastic coating at joints of sections.

3.6 CLEANOUTS

A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated. Set cleanout frame and cover in concrete block 18 by 18 by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving.

3.7 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3000-psi 28-day compressive-strength concrete.

C. Make branch connections from side into existing 4- to 21-inch piping by removing section of existing pipe and installing wye fitting, into existing piping. Encase entire wye with not less than 6 inches of 3000-psi 28-day compressive-strength concrete.

D. Make branch connections from side into existing 24-inch or larger piping or to underground structures by cutting opening into existing unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

1. Provide concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED SANITARY SEWERAGE SYSTEM

A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.

1. Close open ends of concrete or masonry utilities with not less than 8-inch-thick brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.

B. Abandoned Structures: Remove structure and close open ends of the remaining piping, or remove top of structure down to not less than 3 feet below final grade; fill structure with stone, rubble, gravel, or compacted dirt, to within 1 foot of top of structure remaining, and fill with concrete.

3.9 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground Sewerage piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.10 FIELD QUALITY CONTROL

A. A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. Flush piping between manholes and other structures to remove collected debris.
2. Place plug in end of incomplete piping at end of day and when work stops.

B. The Project Civil Engineer shall be notified in advance of all tests, and all tests shall be conducted to his entire satisfaction.

C. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: According to mandrel test.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

D. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
3. Submit separate report for each test.
4. Sanitary Sewerage: Perform air test according to UNI-B-6 and the City of Dover Water & Waster Handbook.
5. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

E. MANDREL TEST:

1. Sanitary sewer pipe shall be deflection tested not less than 30 days after the trench backfill and compaction has been completed. The test shall be conducted by pullin an approved solid pointed mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the inside diameter of the pipe. The mandrel shall be a rigid, nonadjustable mandrel having an effective length of not less than its nominal diameter.
2. Testing shall be conducted on a manhole to manhole basis and shall be done after the line has been completely cleaned and flushed. Any portion of the sewer which fails to pass the test shall be excavated, repaired or realigned and retested with both air and deflection tests.

F. LEAK TESTING USING AIR:

1. Procedures:

    a. Sewers shall be tested in sections of not more than 400 foot lengths unless otherwise approved by the Project Civil Engineer. Each section shall be tested immediately upon completion thereof. Each section shall meet the air pressure drop limitations specified herein.
    b. All material and labor required for leakage tests shall be furnished by the Contractor.
    c. Sewers shall be tested using the low-pressure air method in accordance with the requirements of ASTM C-828 and the Uni-Bell Plastic Pipe Association recommendations, based upon the Ramseier test time criteria. Procedural and equipment details shall be submitted to the Project Civil Engineer prior to acceptance of its use for testing.
    d. A pressure of 4 psi shall be maintained for five (5) minutes with no variation.
    e. If the pressure drops before the appropriate test time has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test. Contractor shall determine, at his own expense, the source or sources of leakage and he shall repair or replace all

defective materials and/or workmanship to the satisfaction of the Project Civil Engineer. The completed pipe installation shall then be retested and required to meet the requirements of this test.

2. Leaks and loss in test pressure constitute defects that must be repaired.
3. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

G. VIDEO INSPECTIONS

1. Televise all sewer lines and manholes per the Municipality's requirements.
2. All video inspections shall be performed utilizing the NASSCO PACP methodology.
3. Video inspection reports shall be reviewed by the Architect and Municipality representative.
4. If the video inspection shows any defects, Contractor shall replace all defective materials and/or workmanship to the satisfaction of the Architect and Municpality. The completed pipe installation shall then be retested and required to meet the requirements of this test.

H. FORCEMAIN TESTING

1. Piping Tests: The Contractor shall furnish all equipment, labor, and materials, including water, pumps, compressors, stopwatch, gauges, and meters for testing. The City shall determine the amount of main to be tested at anyone time and reserves the right to separate the installation into several test sections. All tests must be witnessed by the Owner's Representative and Municipality.
2. Force Main Hydrostatic Tests: Test at not less 75 psi, for two hours with no variation.
3. Copies of testing results must be submitted to Architect and Municipality.

I. TRACER WIRE AND IDENTIFICATION TAPE VERIFICATION

1. Provide tracer wire and identification tape verification according to the City's Water/Wastewater Handbook, section V. F.

END OF SECTION 221313

SECTION 224000

PLUMBING FIXTURES

PART 1. GENERAL

1.01. RELATED DOCUMENTS

A. This project is to be LEED certified. Refer to Division 01 Sections, including "Sustainable Design Requirements", "Construction Waste Managements", and "Commissioning Requirements" for mandatory work which may apply to all contractors, installers, and suppliers.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

3. Product data for Credit WE 3: For water closets, urinals, documentation indicating flush rate in gallons per flush (gpf); for faucets and showerheads, documentation indicating flow rate in gallons per minute (gpm).

1.02. GENERAL

A. For General Mechanical Requirements, see Division 22 Section, *Common Work Results for Plumbing* & Division 01, *General Requirements.*

B. Drawings and general provisions of the Contract, including *General and Supplementary Conditions* and Division 01 specifications apply to this Section.

C. All exposed bolts, screws, etc., shall be vandal proof.

D. All plumbing materials, equipment and fixtures shall be new and of best grade, free of defects and complete with all required appurtenances and accessories.

E. Piping and insulation are specified under other sections.

F. Use "Sani-Sett" setting compound for fixtures.

G. Provide all materials, equipment and perform all labor required to install plumbing system complete as specified, as drawings indicated and as required by the State of Delaware, National Standard Plumbing Code and International Plumbing Code, City of Dover, local

code, and all other authorities have jurisdiction. Comply with the current lead free laws per the requirements of the state in which the project is being constructed.

H. Provide stops for all plumbing fixtures and equipment. Stops are to be accessible.

I. Provide P traps on fixtures for which traps have not been included as part of furnished equipment. Trap size to equal size of fixture tailpiece.

J. All exposed metal parts of fixtures shall be chromium plated brass. Piping, fittings, valves, traps and accessories including escutcheons for piping shall be chromium plated where exposed in finished areas.

K. All faucets for residential kitchen sinks, lavatories, drinking fountains, and ice makers shall be listed for drinking-water or commercial applications by the National Sanitation Foundation (NSF) or Underwriters Laboratory (U.L.). All required faucets shall comply with NSF Standard 61 for both lead content and leaching rate. Submit documentation indicating compliance for all required faucets.

L. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. National Sanitation Foundation (NSF).
2. American Society of Mechanical Engineers (ASME).
3. National Electrical Manufacturers' Association (NEMA).
4. Underwriters Laboratories (UL).

1.03. REFERENCES

A. ANSI/ASME A112.6.1 - Supports for Off-the-floor Plumbing Fixtures for Public Use.

B. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.

C. ANSI/ASME A112.19.1 - Enameled Cast Iron Plumbing Fixtures.

D. ANSI/ASMI A112.19.2 - Vitreous China Plumbing Fixtures.

E. ANSI/ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.

F. ANSI/ASME A112.19.5 -Trim for Water-Closet Bowl, Tanks, and Urinals (Dimensional Standards).

G. ANSI/ARI 1010 - Drinking-Fountains and Self- Contained, Mechanically-Refrigerated Drinking-Water Coolers.

H. ANSI/NFPA 70 - National Electrical Code.

I. IBC - International Building Code

1.04. DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01, Section *General Requirements*.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.05. FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings and per the manufacturer.

B. Confirm that millwork is constructed with adequate provisions for the installation of counter top lavatories and sinks.

1.06. EXTRA MATERIALS

A. Provide two sets of faucet washers and flush valve service kits to the Owner. Provide correspondence to Engineer that extra materials have been turned over to the Owner.

1.07. GRAB BAR COORDINATION

A. For handicapped plumbing fixtures coordinate location of flush valves with grab bars prior to installation.

1.08. ALTERNATES

A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

1.09. LEED REQUIREMENTS

A. Refer to Division 01 Section LEED Requirements for description of work under this Division affected by LEED requirements.

PART 2. PRODUCTS

2.01. PLUMBING FIXTURES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   1. Water Closets, Urinals and Lavatories: Kohler, Crane, American Standard, Falcon, Waterles, Sloan, Zurn.
   2. Water Closet Seats: Kohler, Church, Comfort Seats, Bemis.
   3. Faucets: Chicago Faucet, Kohler, Delta, Speakman, Symmons, T&S Brass, Zurn, Moen
   4. Drains: Chicago Faucet, Engineered Brass Co., Kohler, McGuire
   5. Stops & Supplies: Chicago Faucet, T&S Brass, McGuire, Brass Craft
   6. Flush Valves: Sloan, Delany, Zurn, Toto
   7. Traps: Kohler, McGuire, Dearborn, Engineered Brass Co. (17 gauge min.)

8. Carriers & Supports: Zurn, Josam, J. R. Smith, Mifab, Watts
9. Sinks: Elkay, Just, American Standard
10. Mop Sinks: Stern-Williams, Fiat, Acorn
11. Showers: Powers, Leonard, Speakman, Symmons
12. Electric Water Coolers/Drinking Fountains: Haws, Elkay, Oasis, Halsey Taylor, Acorn
13. Aerators/Shower Heads: Bricor, Neoperl, Omni Flow Controls

A. P-1

1. Watercloset (Infra-red); (battery powered) (wall hung, flush valve with manual override button) Kohler Model K-4325 Kingston Water-Guard Toilet, vitreous china, American Standard 3351, elongated bowl design, siphon jet flushing, wall hung with bolt caps, seat, carrier, supplies and stops.

2. Flushometer: Sloan Model Regal Pro #8111 Optima Plus, Delany, Zurn, American Standard 6065, or approved equal, low consumption (1.28 GPF), exposed diaphragm type, chrome plated brass, battery powered, sensor operated closet flushometer. Unit shall include the following features and accessories: ADA compliant battery powered infrared sensor for automatic "no hands" operation, courtesy flush override button, "low battery" flashing LED, infrared sensor range adjustment screw, initial set-up range indicator light, four (4) size AA batteries, 1-inch I.P.S screwdriver back check angle stop, locking vandal resistant stop cap, sweat solder adapter with cover tube and cast set screw wall flange, adjustable tail piece, vacuum breaker flush connection with one piece bottom hex coupling nut, spud coupling and flange for 1 ½ -inch top spud. Supply with Sloan Model J-212-A, American Standard 6065.862, split ring wall support. Provide 3 year limited Manufacturer's warranty.

3. Seat: Kohler Model K4670-C, American Standard 5901.100, solid plastic white seat with open front and check hinge.

4. Carrier: Zurn, Josam or Watts cast iron watercloset Carrier with fittings as required. ANSI/ASME A112.6.1 adjustable cast iron frame integral drain hub and vent, adjustable speed, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

B. P-1A

1. Watercloset (Handicapped) (Infra-red); (battery powered) (wall hung, flush valve with manual override button) Kohler Model K-4325 Kingston Toilet, American Standard 3351, vitreous china, elongated bowl design, siphon jet flushing, wall hung with bolt caps, seat, carrier, supplies and stops.

2. Flushometer: Sloan Model Regal Pro #8111 Optima Plus, Delany, Zurn, American Standard 6065, or approved equal, low consumption (1.28 GPF), exposed diaphragm type, chrome plated brass, battery powered, sensor operated closet flushometer. Unit shall include the following features and accessories: ADA compliant battery powered infrared sensor for automatic "no hands" operation, courtesy flush override button, "low battery" flashing LED, infrared sensor range

adjustment screw, initial set-up range indicator light, four (4) size AA batteries, 1-inch I.P.S screwdriver back check angle stop, locking vandal resistant stop cap, sweat solder adapter with cover tube and cast set screw wall flange, adjustable tail piece, vacuum breaker flush connection with one piece bottom hex coupling nut, spud coupling and flange for 1 ½-inch top spud**.** Supply with Sloan Model J-212-A split ring wall support. Provide 3 year limited Manufacturer's warranty. Maximum height to top of flush valve shall be 16 - ½".

3. Seat: Kohler Model K4670-C solid plastic white seat with open front and check hinge.

4. Carrier: Zurn, Josam or Watts cast iron watercloset Carrier with fittings as required. ANSI/ASME A112.6.1 adjustable cast iron frame integral drain hub and vent, adjustable speed, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

C. P-2

1. Urinal (Infra-red): (Battery powered, flush valve with manual override button) Kohler model K-4960-ET Bardon water guard, American Standard 6506.010, urinal, vitreous china, washout design, 3/4-inch top spud inlet, 2-inch outlet and carrier.

2. Flushometer: Sloan Model Regal Pro #8186-1.0-OR, Delany, Zurn, American Standard 6063.101, or approved equal, low consumption (pint flush), exposed diaphragm type, chrome plated brass, battery powered, sensor operated urinal flushometer. Unit shall include the following features and accessories: ADA compliant battery powered infrared sensor for "no hands" operation, "low battery" flashing LED, infrared sensor range adjustment screw, initial set-up range indicator light, four (4) size AA batteries, courtesy flush override button, ¾ -inch I.P.S. screwdriver back check angle stop, locking vandal resistant stop cap, sweat solder adapter with cover tube and cast set screw wall flange, adjustable tail piece, vacuum breaker flush connection with one piece bottom hex coupling nut, spud coupling and flange for ¾ -inch top spud. Sloan Model J-212-A split ring wall support. Provide 3 year limited Manufacturer's warranty.

3. Carrier: Zurn, Josam or Watts cast iron urinal carrier with fittings as required. ANSI/ASME A112.6.1A; cast iron and steel frame with tubular legs, legs for floor and wall attachment, threaded fixtures studs for fixture hanger, bearing studs.

D. P-2A

1. Urinal (Handicapped) (Infra-red); (Battery powered, flush valve with manual override button) Kohler model K-4960-ET Bardon water guard, American Standard 6506.010, urinal, vitreous china, washout design, 3/4-inch top spud inlet, 2-inch outlet and carrier. Fixture lip mounted 17-inches above finished floor. Unit and installation shall comply with the American Disabilities Act Guidelines and ANSI A117.1 requirements for people with disabilities.

2. Flushometer: Sloan Model Regal Pro #8186-1.0-OR, Delany, Zurn, American Standard 6063.101, or approved equal, low consumption (pint flush), exposed

diaphragm type, chrome plated brass, battery powered, sensor operated urinal flushometer. Unit shall include the following features and accessories: ADA compliant battery powered infrared sensor for "no hands" operation, "low battery" flashing LED, infrared sensor range adjustment screw, initial set-up range indicator light, four (4) size AA batteries, courtesy flush override button, ¾-inch I.P.S. screwdriver back check angle stop, locking vandal resistant stop cap, sweat solder adapter with cover tube and cast set screw wall flange, adjustable tail piece, vacuum breaker flush connection with one piece bottom hex coupling nut, spud coupling and flange for ¾-inch top spud. Sloan Model J-212-A split ring wall support. Provide 3 year limited Manufacturer's warranty.

3. Carrier: Zurn, Josam or Watts cast iron urinal carrier with fittings as required. ANSI/ASME A112.6.1A; cast iron and steel frame with tubular legs, legs for floor and wall attachment, threaded fixtures studs for fixture hanger, bearing studs.

E. P-3

1. Lavatory (Infra-red): (wall hung) (battery operated) Chicago faucet, Kohler Model K-2032 Greenwich, American Standard Lucerne 0356.421, wall mount lavatory, vitreous china with 20-inch x 18 bowl, and 4-inch faucet centers. Provide concealed arm Carrier.

2. Faucet: Provide sensor operated faucet. Sensor operated faucet shall be Chicago Faucet Model 116.606.AB.1 with integral 4” center body, sensor and solenoid above deck within faucet, filter, chrome finish and vandal resistant. Unit shall operated on 6 VDC lithium (included). Unit shall include integral check cartridges, 0.5 GPM E2805 vandal proof outlet.

3. Thermostatic Mixing Valves: Provide and install below fixture. See Part 2 “Thermostatic Mixing Valves”.

4. Strainer: Chicago Faucet Model 327A, American Standard 2411.015 with 1 ¼ inch tailpiece, non removable brass strainer, grid strainer waste, chrome plated finish.

5. P-Trap: Chicago Faucet Model 337, American Standard 7723.018 offset drain assembly.

6. Stops: Chicago Faucet Model 1005ABCP valve stops with 3/8-inch loose key cap and removable tee handle, wall flange, chrome plated finish.

F. P-3A

1. Lavatory (Infra-red) Handicapped: (wall hung) (battery operated) Chicago faucet, Kohler Model K-2032 Greenwich, American Standard Lucerne 0356.421, wall mount lavatory, vitreous china with 20-inch x 18 bowl, and 4-inch faucet centers. Provide concealed arm Carrier.

2. Faucet: Provide sensor operated faucet. Sensor operated faucet shall be Chicago Faucet Model 116.606.AB.1 with integral 4” center body, sensor and solenoid above

deck within faucet, filter, chrome finish and vandal resistant. Unit shall operated on 6 VDC lithium (included). Unit shall include integral check cartridges, 0.5 GPM E2805 vandal proof outlet. Unit shall be ADA compliant.

3. Thermostatic Mixing Valves: Provide and install below fixture. See Part 2 “Thermostatic Mixing Valves”.

4. Lavatory Protective Enclosure: Provide and install Truebro Model # 2018 lav shield lavatory enclosure on all lavatories with sensor operated faucets. Protective enclosure shall be ADA conforming, 20-inch x 18-inch wheel chair accessible. Unit shall have white finish, be constructed of high impact, stain resistant vinyl, and include seven (7) wall anchors.

5. Strainer: Chicago Faucet Model 327A, American Standard 2411.015 with 1 ¼ inch tailpiece, non removable brass strainer, grid strainer waste, chrome plated finish.

6. P-Trap: Chicago Faucet Model 337, American Standard 7723.018 offset drain assembly.

7. Stops: Chicago Faucet Model 1005ABCP valve stops with 3/8-inch loose key cap and removable tee handle, wall flange, chrome plated finish.

G. P-4

1. Mop Receptor (Floor Unit) (36-inch X 24-inch): Stern Williams 'ELFIN" Model EBR-66, Flat SBC3636, or approved equal, 36-inch x 24-inch x 6-inch dimensions. Shoulders shall be not less than 3-3/4 -inch high inside measurement, and not less than 1 -1/4-inch wide. Unit shall be constructed of Terrazzo composed of pearl grey marble chips in white portland cement, designed to develop a compressive strength of 3000 psi seven days after casting. Unit shall be ground smooth, grouted and sealed to resist stains. Furnish unit with cast brass drain with stainless steel strainer cast integral and 3-inch caulk connection. Furnish unit with anodized extruded aluminum bumper guard for exposed sides. Provide and install stainless steel BP splash catcher panels on adjacent walls.

2. Faucets: Chicago faucet 897-RCF(rough chrome finish), Speakman SC-5811-RCD, American Standard 8344.112.004, or approved equal with cast brass, chrome plated body, vacuum breaker spout, stops in arms. Faucet shall include 3/4-inch hose thread outlet, Pail Hook, and wall brace

H. P-5

1. Electric Water Cooler (Dual Height) (Handicapped) Recessed Unit: Haws Model H1011.8, Acorn or approved equal, Barrier-free, dual height unit with mounting frame. Air cooled electric water cooler shall be capable of delivering 8 GPH at 90 degrees F ambient 80 degrees F, inlet water and 50 degrees F outlet drinking water. Top shall be stainless steel; bubblers shall be one piece, polished chrome plated with anti-squirt angle stream cabinet shall be No. 4 Satin finish stainless steel. Unit shall be supplied with junction box for field wiring of unit. Lower spout outlet shall be mounted 36 inches above finished floor. Upper spout outlets shall be mounted 40-

inches above finished floor. Water cooler and installation shall conform to all requirements of American Disabilities Act Guidelines and ANSI A117.1.

2. Refrigerant shall be R-134a or equivalent environmentally friendly refrigerant.

3. Provide Carrier as manufactured by Zurn, Josam, Amcon, Smith, Mifab, or approved equal.

I. P-5A

1. Exterior Drinking Fountain (Non Freeze Type) (Dual Height/Handicapped Outdoor Wall Mounted): Acorn AIG2400B-BP6 or approved equal, wall mounted, vandal resistant bi-level square drinking fountain made from 18 gauge, 304 stainless steel bowls mounted into stainless steel, heavy duty, 11 gauge galvanized support arms with a stainless steel back panel. Unit shall be activated by front mounted self-closing buttons, by using less than 5 pounds of force which activates internally mounted valves with adjustable stream regulators controlling the water flow. Bubbler head shall be polished chrome plated brass, with non-squirt features and shall operate on water pressure range of 20-105 psig. Drinking fountain and installation shall conform to all requirements of American Disabilities Act Guidelines and ANSI A117.1. Unit shall be resistant to sunlight, heat, moisture, and water. Furnish unit with 100 mesh inlet strainer, freeze resistant valve system, vandal resistant bottom galvanized steel plate, screws, and mounting plate.

2. Carrier: Furnish each unit with Model CSC concealed support carrier.

J. P-6

1. Hand Wash Sink: Hand wash sink provider under another Division of these specifications. Under this division, provide rough-in and final connection.

K. P-7

1. Shower: Enclosure by other. Provide floor drains as specified on contract drawings. Provide rough-in and final connections of cold water, hot water, vent, and waste. Provide and install Powers Process Controls P902H pressure balance shower valve with check stops and 3 ports for shower application. Unit shall include showerhead, arm and flange. Provide round face plate with red/blue indication insert. Escutcheon shall be chrome plated stainless steel. Furnish each shower with a Speakman, Bricor, Chronomite or approved equal low flow (1.0 GPM) showerhead.

2. Shower Head: Bricor, Speakman, Chronomite, or approved equal low flow (1.0 GPM at 30 psig) wall mounted shower head with water conserving pressure compensating autodevice.

L. P-7A

1. Shower (Roll-In) (Handicapped): Enclosure and surrounding shower walls are provided under the Architectural Division of these specifications. Provide floor

drains as specified on Contract Drawings. Provide rough-in and final connection of cold water, hot water, vent, and waste. Furnish and install Speakman Model VS-1970, Powers Process Controls P902H or approved equal pressure balance shower valve with check stops and three (3) ports for shower application. Unit shall include shower head, arm, flange, transfer valve, and hand held combination unit. Unit shall include Speakman Bricor, Chronomite or equivalent low flow (1.0 GPM) wall mounted shower head with water conserving pressure compensating auto device. Provide standard 69-inch white vinyl reinforced hose, chrome plated brass supply with wall flange, 44-inch slide bar with adjustable upper bracket and mounting screws. Hand held shower shall include in-line vacuum breaker and quick disconnect for storage of hand held shower by Teachers. All exposed parts shall be polished chrome plated. Shower and installation shall conform to all requirements of American Disabilities ACT Guidelines and ANSI A117.1.

2. Shower Head: Bricor, Speakman, Chronomite, or approved equal low flow (1.0 GPM at 30 psig) wall mounted shower head with water conserving pressure compensating autodevice.

M. P-8

1. Two Compartment Sink: The two compartment sink shall be provided under another Division of these specifications. Provide rough-in and final connection under this Division.

N. P-9

1. Ice Maker: Provided in another Division of specifications. Under this Division provide rough-in and final connection including indirect waste outlet to floor sink and wall box.

2. Ice maker rough-in shall include a Guy Gray recessed ice maker wall box. Ice maker wall box shall be Model BIM875 or the approved equal of Watertight. Unit shall be complete with ½ -inch FIP inlet x ¼ -inch O.D. outlet compression angle valve. Overall dimensions shall not exceed 10 3/4-inch wide x 9-inch high x 3 5/8-inch deep. Box shall be 16 gauge steel finished in a white epoxy finish. Provide sufficient copper tubing from wall box to ice maker to allow movement without disconnecting ice maker from wall box.

3. Ice Maker Cold Water Inlet Filter

a). Contractor shall provide and install a cartridge type water filter on the cold water inlet to the owner furnished ice maker as detailed on the contract drawings. Housing shall be constructed of PVC with 3/4-inch NPT connections. Heads shall be cast bronze nickel plated with nickel plated "T" handle cap nut. Unit shall have pet cock bottom drain. Housing shall contain two (2) 20 micron cartridge filters. The entire filter assembly shall be rated for 150 psig. Unit shall be capable of handling a minimum 6 gpm. Housing shall be as manufactured by Keystone or approved equal.

b). Install filter housing to allow access for service and filter replacement.

2.02. THERMOSTATIC MIXING VALVES (INDIVIDUAL FIXTURE TYPE)

A. Furnish and install thermostatic mixing valves where indicated at public lavatories, and below handsinks.

B. Thermostatic mixing valves shall be Bradley S59-4000A, Watts, or approved equal for installation under lavs. Provide in-line check valves, lead free body, escutcheon plates, inlet filters, and insulation as required. Thermostatic mixing valves shall be adjusted to deliver 105 degrees Fahrenheit hot water when supplied with 140 degrees Fahrenheit delivering hot water. Furnish with adjusting cap with locking feature.

C. The thermostatic mixing valves shall be ASSE standard 1016-96, ASSE 1017, ASSE 1069, and ASSE 1070 listed.

2.03. PLUMBING FIXTURE SUPPORTS

A. Wall mounted urinal supports, Josam 17810 plate type with cast iron headers, box steel stanchions, block type cast iron feet with bearing plate.

B. Support for wall mounted urinals, lavatories, sinks, drinking fountains, etc.:

1. Where fixtures are supported from concrete or cinder block walls, install No. 10 USSG Steel plate on the opposite side of the wall and bolt hangers or supports through plate. Where opposite side of wall is exposed to view, place bolts in core of blocks and fill core with cement.

2. Where lavatories with wall hangers have been specified and fixtures are supported from metal stud frame partitions, fixture brackets or mounting lugs shall be through bolted to steel channel crosspieces not less than 1-1/2-inch wide anchored to studs. Bolt heads shall be welded to channel web.

3. Concealed arm type lavatory supports, Josam 17100 with cast iron headers, box steel stanchions, block type cast iron feet and header; and chrome plated cast brass threaded escutcheons for slab type lavatories.

4. Flush mounted drinking water cooler supports, Josam 17550 plate type, box steel stanchions, block type cast iron feet.

C. Water closet chair carriers, Josam 12000 Series for horizontal and vertical installations.

2.04. HANDICAPPED LAVATORY/SINK INSULATION

A. All handicapped lavatories and sinks shall be provided with under counter pipe and trim insulation.

B. Insulation shall be fully molded "P" trap and angle valve insulated Hand-I-Lav Guard, Truebro Model #101, 102, and 105 to suit.

C. Insulation to meet ADA #4 19.4, ANSI A117.1, and International Plumbing Code.

D. Self extinguishing ASTM D635 burn characteristics, thermal conductivity ASTM C177 K-Value ' 1.17.

E. Insulation thickness to be minimum 2 inch.

F. Where lav. Guards are provided insulation may be omitted.

PART 3. EXECUTION

3.01. GENERAL INSTALLATION REQUIREMENTS

A. Install all equipment in accordance with manufacturer's instructions.

B. Setting heights of lavatories, drinking fountains, etc., shall be as directed prior to installation and shall be coordinated with Architectural Contract Documents.

C. Install floor mounted fixtures only after finished floor has been installed.

D. Provide rubber concussion washers between vitreous china fixtures and supporting brackets.

E. Protect chromium plated trim from corrosive solutions used to clean tile work.

F. Provide white, silicone caulking where fixtures come in contact with walls and floors. Sealant shall be mildew resistant type in accordance with ANSI A-136.1.

G. Install components plumb and level.

H. Install and secure fixtures in place with wall supports, wall carriers and bolts.

I. Solidly attach water closets to floor with lug screws. Lead flashing is not intended to hold fixture in place.

J. Install flush valve handles on the open side of all ADA waterclosets in accordance with ANSI requirements.

K. Fixtures shall be vitreous china unless otherwise noted. Cast iron fixtures shall have acid resisting enamel finish unless noted otherwise, color shall be white.

L. Flush valves shall be self-closing, non-hold open type with vacuum breaker and perform satisfactorily when subject to inlet water pressure varying from 15 to 75 psi. Flush valves shall be as specified, Sloan, Delaney, Zurn, Toto, or approved equal.

M. Provide flexible risers and loose key stops for all lavatories and sinks. Provide 17 ga. chrome plated brass tail piece and trap with cleanout for all lavatories and sinks.

N. Fittings for fixtures supplied by others, such as kitchen equipment are provided under another division of these specifications. Connections of these fixtures to the plumbing system are provided under this section.

O. Coordinate with plumbing piping and related electrical work to achieve a complete operating system.

P. All plumbing vents within a 10'-0" radius of exhaust vents shall be extended to a height of 3'-0" above exhaust vent crown.

Q. All plumbing vents within a 10'-0" radius of any rooftop unit or intake louver shall be extended to a height of 3'-0" above fresh air intake.

R. Slopes and invert elevations of all interior piping shall be established before any piping is installed in order that proper slopes will be maintained. All piping shall be located and determined where to be run to avoid conflict with other trades.

S. Unless otherwise noted, all plumbing piping shall be routed as high as possible between bottom of roof joists and above ceiling to allow proper installation of ductwork, fire protection piping, conduits, etc.

T. Coordinate with Architectural Drawings before roughing in plumbing.

U. All openings in ceilings and plenum walls for plumbing shall be sealed air tight and protected with fire stop.

V. See site plan for extent of all piping leaving and entering building.

W. See domestic water riser diagrams for location of valves, shock absorbers, etc.

X. Make proper HW, CW, re-cir., waste, and vent connections to all fixtures and equipment even though all branch main, elbows and connections are not shown.

Y. Unless otherwise noted, sanitary waste piping shown is below floor and all other piping is overhead, above ceiling. Domestic hot, cold and re-circ. water piping shall be installed between ceiling and attic insulation.

Z. Unless otherwise noted, horizontal sanitary piping shall be pitched 1 percent.

AA. Unless otherwise noted, all domestic water piping and fire protection piping shall be installed on heated side of ceiling insulation.

BB. All piping and installation shall comply with all local and national plumbing codes. Test piping as required by plumbing code and authority having jurisdiction.

CC. For sizes of all domestic water piping see plumbing fixture schedule and domestic water riser diagrams.

DD. For sizes of all sanitary and vent piping see plumbing fixture schedule and sanitary/vent riser diagrams.

3.02. PLUMBING SPECIALTY INSTALLATION REQUIREMENTS

A. General: Install plumbing specialty components, connections, and devices according to

manufacturer's written instructions.

B. Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

C. Secure supplies to supports or substrate.

D. Install individual stop valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve as appropriate is not indicated.

E. Install water-supply stop valves in accessible locations.

F. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

G. Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

3.03. FITTINGS FOR FIXTURES SUPPLIED BY OTHERS

A. Fixtures, such as a two compartment sink, are provided under other divisions of the specifications. Fittings, accessories and connection of these fixtures to the plumbing system are provided under this section.

B. Rough-in and final connection includes but is not limited to all domestic water, waste, and vent systems. Furnish stops, strainers, vacuum breakers, and under counter insulation where not furnished under another Division of these specifications.

3.04. TESTING

A. After plumbing fixtures are connected, all piping and fixtures shall be tested for operation and a smoke or peppermint test shall be made on all soil, waste and vent piping.

B. After the building has been occupied and the various equipment is in actual use, the Contractor shall make an operating test of all equipment at a time directed by the Engineer to determine that all contract requirements are met.

3.05. CLEANING AND STERILIZATION

A. After final testing for leaks, all potable water lines shall be thoroughly flushed, by plumbing contractor, to remove foreign material. Before placing the systems in service, sterilize the new water lines in accordance with local health department codes and at a minimum according to the following procedure:

1. Through a 3/4-inch hose connection in each branch main and building main, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 ppm. Plumbing Contractor shall provide plumbing connections and power for pumping chlorine into system.

2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.

3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 ppm chlorine, retain this water in the system for at least three (3) hours.

4. CAUTION: Over-concentration of chlorine and more than three (3) hours of retention may result in damage to piping system. It is not necessary to retain chlorine in any system for twenty-four hours to achieve sterilization. AWWA states that 200 ppm chlorine for three hours is sufficient.

5. At the end of the retention period, no less than 100 ppm of chlorine shall be present at the extreme end of the system.

6. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 ppm.

7. Obtain representative water sample from the system for analysis by an independent and recognized bacteriological laboratory.

8. If the sample tested for coliform organisms is negative, a letter and laboratory report shall be submitted by the service organization to the Contractor, certifying successful completion of the sterilization. Additionally, this report shall be forwarded to the Owner as well as be included in the O&M Manual.

9. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.

10. Take precautions to avoid use of plumbing fixtures and domestic water systems during sterilization period. Place signs on all plumbing fixtures and outlets during sterilization period.

3.06. EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

3.07. PREPARATION

A. Confirm rough-in location and size of fixtures and openings prior to commencing work.

B. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.08. INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.09. ADJUSTING

A. Adjust stops, valves, infrared fixtures for intended water flow rate to fixtures without splashing, noise, or overflow.

3.10. CLEANING

A. At completion, clean plumbing fixtures and equipment. Polish all chrome plated faucets, accessories, equipment, and piping.

B. All electric water cooler coils shall be cleaned of all construction dust and debris prior to building occupation by Owner.

3.11. FIXTURE HEIGHTS

A. Install fixtures to heights above finished floor as required by local Plumbing Code, Americans with Disabilities Act (A.D.A.), Authority Having Jurisdiction, and Architectural Contract Drawings. In the absence of a local code requirements, install fixtures to heights above finished floor as follows.

B. Water Closet

1. Standard 15 inches to top of bowl rim.
2. Handicapped 18 inches to top of seat.

C. Urinal

1. Standard 22 inches to top of bowl rim.
2. Handicapped 17 inches to top of bowl rim.

D. Lavatory

1. Standard 31 inches to top of basin rim.
2. Handicapped 34 inches to top of basin rim.

E. Drinking Fountain

1. Standard 36 inches to top of basin rim.
2. Handicapped 34 inches to top of basin rim.

F. Water Closet Flush Valves

1. Standard 11 inches min above bowl rim.
2. Recessed 10 inches min. above bowl rim.

G. Shower Heads

1. Adult male 69.5 inches to bottom of head.
2. Adult female 64.5 inches to bottom of head.
3. Handicapped (unisex) with handheld 76 inches to top of head arm.

END OF SECTION

SECTION 22 40 05

PLUMBING EQUIPMENT

PART 1. GENERAL

1.01. RELATED DOCUMENTS

A. This project is to be LEED certified. Refer to Division 01 Sections, including "Sustainable Design Requirements", "Construction Waste Managements", and "Commissioning Requirements" for mandatory work which may apply to all contractors, installers, and suppliers.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.02. GENERAL

A. For General Mechanical Requirements, see Division 22 Section, *Common Work Results for Plumbing* & Division 01, *General Requirements.*

B. Drawings and general provisions of the Contract, including *General and Supplementary Conditions* and Division 01 specifications apply to this Section.

C. All exposed bolts, screws, etc., shall be vandal proof.

D. All plumbing materials and equipment shall be new and of best grade, free of defects and complete with all required appurtenances and accessories.

E. Piping and insulation are specified under other sections.

F. Provide all materials, equipment and perform all labor required to install plumbing system complete as specified, as drawings indicated and as required by the State of Delaware, National Standard Plumbing Code , International Plumbing Code, City of Dover Code, the local code, and all other authorities have jurisdiction.

G. Provide stops for all plumbing equipment. Stops are to be accessible.

H. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

I. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. National Sanitation Foundation (NSF).
2. American Society of Mechanical Engineers (ASME).
3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
4. National Electrical Manufacturers' Association (NEMA).
5. Underwriters Laboratories (UL).

J. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.03. REFERENCES

A. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.

B. ANSI/ASE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

C. ANSI A112.21.1 - Floor Drains.

D. ANSI A112.21.2 - Roof Drains.

E. ANSI A112.26.1 - Water Hammer Arrestors.

F. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.

G. PDI WH-201 Water Hammer Arresters.

H. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

I. ASME Section VIIID - Pressure Vessels; Boiler and Pressure Vessel Codes.

J. ANSI/NFPA 70 - National Electrical Code.

K. ANSI/NEMA 250 - Enclosure for Electrical Equipment (1000 Volts Maximum).

L. IBC - International Building Code

1.04. DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of General Requirements.

B. Accept equipment on site in factory packaging. Inspect for damage.

C. Protect installed equipment from damage by securing areas and by leaving factory packaging in place to protect equipment and prevent use.

1.05. FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings and per the manufacturer.

1.06. ALTERNATES

A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

1.07. LEED REQUIREMENTS

A. Refer to Division 01 Section, "LEED Requirements" for description of work under this Division affected by LEED requirements.

1.08. LEAD FREE REQUIREMENTS

A. All plumbing fixtures, equipment, and devices that contact potable water must be lead free per the State requirements.

PART 2. PRODUCTS

2.01. FLOOR AND ROOF DRAINS

A. Provide Nikaloy strainers on all floor drains unless specified otherwise.

B. Provide flashing clamps on all drains penetrating waterproofing membrane.

C. Provide suitable flashing material and clamping collar for drains which are not set in place when slab is poured.

D. Provide backwater valves for all floor drains connecting directly to the storm water system. Depending on conditions of the particular installation backwater valves may be an integral part of the drains or a separate device. Accessibility to valves must be maintained for maintenance. Provide an adequately sized extension sleeve up to floor or grade as required.

E. Backwater valves are normally closed, flapper type with bronze or brass seat and disc and stainless steel pin.

F. Provide traps for all floor drains connected to the sanitary system.

G. All priming lines shall be connected to automatic trap primer. All floor drains shall be connected to trap priming stations.

H. Provide Josam 26200 vertical expansion joint in each rain leader that does not have 90 degrees offset downstream of the roof drain. The expansion sleeve shall be bronze and shall conduct the rain water beyond the packing. Install expansion joints in accessible locations for repacking.

I. In lieu of joints specified in piping section, neoprene gaskets may be used if designed for use with the drains and cleanouts employed and if approved by the local plumbing authority.

J. Schedule of Drains and Accessories:

1. RDR.-1: Roof Drain: Zurn Z-100 15-inch diameter roof drain, dura coated cast iron body with combination membrane flashing clamp/gravel guard and low silhouette aluminum locking dome. Provide with support ring, adjustable top with wide roof flange, large sump with anchor flange, bottom outlet inside caulk connection and deck clamp. Provide overflow drain as detailed on contract drawings.

2. FDR.-1: General Service Floor Drain: Zurn ZN-415 floor and shower drain, dura coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with Type "B" polished nickel bronze strainer. Provide with ½ -inch trap primer connection.

3. FDR.-2: Mechanical Room Floor Drain: Zurn Z-566 12-inch square open top drain, dura coated cast iron body with bottom outlet, ½ top grate, large suspended cast iron sediment bucket. Provide flashing flange and ½" -inch trap primer connection.

4. FDR.-3: Floor Sink: Zurn Z-1920 Sani-Flor recptor, 16-inch x 16-inch x 7-inch depp cast iron body and ssquare slotted heavy duty grate, with white acid resisting coated interior and top, complete with aluminum anti splash interior bottom dome strainer. Provide two (2) removable ½ grates with each unit. Provide with ½ inch trap primer connection. Provide stainless steel mesh bucket screen with each floor sink.

K. Approved Manufacturers: Josam, J.R. Smith, Zurn, Wade, Ancon, Mifab, Watts.

2.02. CLEANOUTS

A. Provide cleanouts in sanitary and storm drainage systems at ends of runs, at changes in direction, near the base of stacks, every 50 feet in horizontal runs, of 4-inch diameter or less, every 100 feet in horizontal runs over 4-inches, and where indicated.

B. Cleanouts shall be full size of pipe up to 4-inches and shall be 4-inches for larger sizes. Where installed in finished floors inserts shall match adjacent floor construction.

C. Materials and Approved Manufacturers: Josam, J.R. Smith, Zurn , Wade or Ancon, Mifab, Watts, equal to Josam numbers given below:

1.	Concealed Piping	C.I. Pipe
2.	Unfinished Areas	
3.	Floors	56070
4.	Walls	58790
5.	Finished Areas - Floors	
6.	Terrazzo	56040-13
7.	Composition Tile	56000-12
8.	Ceramic Tile	56000
9.	Carpet	56070-14

10. Carpet insert to match adjacent carpet in type, color and grade.

11. Finished Areas - Walls

12.	Plaster/Dry Wall	58770
13.	Tile/CMU	58790

2.03. WALL HYDRANTS

A. Wall Hydrant (Exterior): Josam 71000 Series Hydrasan anti-siphon wall hydrant, 3/4-inch non-freeze, key operated wall hydrant with hinged locking cover, polished bronze box and cover and bronze casing and integral vacuum breaker. Seat and disc shall be removable from front of the hydrant. Wall thickness; see architectural drawings. Wall hydrants shall conform to ANSI/ASSE 1019 with wall plate, lock shield and removable key.

B. Approved Manufacturers: Josam, Wade, Zurn, J.R. Smith, Mifab, Watts, or approved equal.

2.04. SHOCK ABSORBERS

A. Provide shock absorbers equal to Josam Shokstops at all fast closing valves, at the top of all cold water risers, at each flush valve or battery of flush valves, and where indicated. Sizes and locations shall be in accordance with PDI Standard WH 201.

B. Shock absorbers shall conform to ANSI A112.26.1, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psig working pressure.

C. Approved Manufacturers: Josam, Wade, Zurn, J.R. Smith, Sioux Chief, Watts, or approved equal.

2.05. VACUUM BREAKERS

A. Provide vacuum breakers on water connections to fixtures and equipment where minimum air gaps required by Plumbing Code are not possible and on hose bibbs and other outlets to which hoses can be attached.

B. Vacuum breakers not subject to back pressure, Watts No. 288A; vacuum breakers subject to back pressure, Watts Series 9D or for hose threads, Watts Series 8A.

C. Provide atmosphere vacuum breakers at all water connections to hose spray units as required by Plumbing Code.

D. Hose connection backflow preventers shall be ASSE 1052, suitable for at least 5 gpm flow and applications with up to 10 foot head back pressure. Include two (2) check valves, intermediate atmospheric vent, and non-removable, ASME B1.20.7 garden-hose thread on outlet.

E. Hose connection vacuum breakers shall be ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7 garden-hose threads on outlet. Units attached to rough-bronze finish hose connections may be rough bronze.

F. Approved manufacturers: Watts, Beeco, B&K Industries, Zurn, Sparco, Conbraco or approved equal.

2.06. HOSE BIBBS

A. Chicago Faucet No. 952 or approved equal hose and faucet. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose threaded spout, polished chrome plated where exposed in finished areas, with hand wheel and removable key, integral vacuum breaker in conformance with ANSI/ASSE 1011.

B. Hose bibbs in finished areas shall be polished chrome finish.

C. Approved Manufacturers: Chicago Faucet, American Standard, Crane, T&S Brass, Watts.

2.07. DOMESTIC WATER CARTRIDGE TYPE RE-CIRCULATING PUMPS

A. Provide and install domestic water re-circulating pumps of the size, capacity and electrical characteristics as indicated on the contract drawings. Pumps shall be in-line cartridge circulators as manufactured by TACO, Bell and Gossett, Thrush, Armstrong, or approved equal. Units shall be U.L. listed.

B. Pumps shall be non-overloading throughout the range of the curves. Pumps shall have center line discharge for positive venting, flanged bodies, and same size suction and discharge.

C. Motors shall be permanent split capacitor with built-in overload protection. Impellers shall be non-metallic. Casings shall be bronze construction. Shafts shall be ceramic with carbon bearings. Units shall be rate for 125psi maximum pressure and 220 degrees F maximum temperature.

D. All circulators utilized for domestic water service shall be all bronze construction or stainless steel construction. Shaft orientation and junction box orientation shall be installed per manufacturer's recommendations.

2.08. BACKWATER VALVES

A. Backwater valves shall be provided at all connections of floor drains to stormwater piping systems and where indicated on contract drawings.

B. Backwater valves shall be ANSI A112.21.2, galvanized cast iron body and cover, brass valve, access cover, extension sleeve and cover.

C. Backwater valves shall be equal to Josam 67520-15.

D. Extend access cover to finished floor and terminate in cleanout.

E. Approved Manufacturers: Josam, Zurn, Wade, Smith, Ancon or approved equal.

2.9. ELECTRIC DOMESTIC WATER HEATER

A. Furnish and install electric water heaters of the size, capacity, and arrangements indicated on

the Contract Drawings. Heater shall be A. O. Smith Model DEN/DEL, Lochinvar, State or approved equal. Water heaters shall be UL listed. The domestic water heater and installation shall meet all requirements of the State of Maryland Boiler and Pressure Vessel Safety Act and Regulations including amendments and addenda latest edition. The domestic water heater and installation shall comply with all requirements of the local Boiler Inspector. Contractor must submit any deficiencies cited by the Boiler Inspector to the Engineer and Owner for review.

B. Tanks shall be glass lined with magnesium anode and an approved working pressure of 150 psi. Tank shall have a steel jacket with a baked enamel finish. Electric elements shall be screw in design complete with adjustable thermostatic controls. Tank shall be insulated to conform with latest ASHRAE 90 Standards.

C. Accessories shall include an A.S.M.E. rated temperature/pressure relief valve, drain valve, electrical junction box, and terminal block.

D. Install water heaters on 4 inch high concrete housekeeping pad unless otherwise detailed on the drawings.

2.10. BACKFLOW PREVENTER (DOUBLE CHECK VALVE ASSEMBLY TYPE) (VERTICAL TYPE)

A. Furnish and install double check valve assembly backflow preventers at incoming water services and where else indicated on contract documents.

B. The assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module sets and seat discs shall be replaceable.

C. Service of all internal components shall be through a single access cover secured with stainless steel bolts. The assembly shall include two resilient seated isolation valves and four top mounted, resilient seated test cocks.

D. Furnish each backflow preventer with the following accessories and options:

1. OS & Y Gate Valves.
2. Ball Valve Test Cocks.
3. Approval for vertical up flow installation.

E. Provide minimum 18-inch clearance for servicing and testing.

F. The assembly shall meet the requirement of ASSE Std 1012 and AMCA Std C510.

G. Double check valve backflow preventers shall be Watts No. 709, Conbraco, Wilkens, Ancon, or approved equal.

2.11. TRAP PRIMING STATION-AUTOMATIC TRAP PRIMER

A. Trap priming stations shall be Precision Plumbing Products, Inc., Electronic Trap Priming manifold Model PT. The manifold shall supply a minimum of 2 ounces of potable water per opening at 20 PSIG once in each 24 hour period. The Electronic Trap Priming Manifold

must be capable of equally priming from 4 through 30 individual floor drain traps.

B. The unit shall be factory assembled and prepiped, and shall include a bronze body 3/4-inch female NPT WOG rated ball valve 3/4-inch, Water Hammer Arrestor, copper barrel with brass piston and type "L" copper sweat connection, electronic brass body 3/4-inch solenoid valve, and type "L" copper manifold with brass 2-inch compression fitting and orifice opening for precision water distribution to each floor drain trap. Unit shall be pre-piped with atmospheric vacuum breaker.

C. Electronic components shall include single point power connection at 120 volt 1 phase 60 hertz, manual over-ride switch, minimum 5 amp breaker, 24 hour geared timer with relay and 5 second dwell function.

D. All components shall be factory assembled, tested and supplied in a 16 gauge steel enclosure suitable for surface or recess mounting, as indicated on contract drawings. In addition, all components must comply with nationally recognized standards. The Precision Plumbing Products Electronic Trap Priming Manifold shall be fully warranted for the life of the plumbing system.

E. When only a single trap primer is required, as in the case of a restroom with one floor drain in a toilet (or similar) the contractor may submit, in lieu of an electronic multiple station, a single station for review by the Engineer. The fixture serving the trap primer must be within 10' of the trap. Components shall be brass, bronze, and chrome, of the highest quality.

F. Access door shall be finished with a prime coat and fire rated where installed in a rated wall. Access door latch shall be Allen key type.

2.12. DOMESTIC WATER METER WITH ATC INTERLOCK CAPABILITIES

A. Furnish and install a bronze magnetic drive flanged turbo-water meter on incoming water service to building and where indicated. The water meter shall be Model WPX-211 as manufactured by Niagara, Rockwell, Hersey, or approved equal. Unit shall be sized and selected so as not to exceed the scheduled maximum pressure drop at design flow.

B. Main cases for all sizes shall be cast Water Works bronze. Size, model and direction of flow shall be cast, in raised characters, on both sides of the Main cases.

Operating Characteristics		
Meter Size	Low Flow (95percent minimum)	Normal Range (100.0 +/- 1.5 percent)
2-inch	3	4 to 160
3-inch	4	5 to 350
4-inch	10	15 to 1000
6-inch	20	30 to 2000
10-inch	55	55 to 5500

1. 8-inch and 12-inch pipeline size applications can be accomplished by using the 6-inchand 10-inch size meters respectively with the appropriate tapered, concentric

reducers.

C. Meters shall have performance capabilities of continuous operation up to the rated maximum flows as outlined above without affecting long term meter accuracy or causing undue wear. Meters shall also have a 25 percent flow capacity in excess of the maximum flows listed for intermittent flow demands.

D. The measuring chamber shall be of unitized construction (i.e., complete with measuring element, calibration device and register in one assembly). The measuring chamber shall be capable of operating within above listed accuracy limits without recalibration when transferred from one main case to another. The measuring element shall be mounted on a horizontal stationary shaft with sleeve bearings and be essentially weightless in water.

E. The register shall be permanently hermetically sealed; all registers of similar size and registration to have a standard ratio gear reduction so as to permit interchange ability. The register shall be assembled to measuring chamber in a tamper proof manner so removal can be made only after measuring chamber is removed from the maincase. Sweep hand reading and odometer wheel details will conform to American Water Works Standard C-701, as most recently revised.

F. All reduction gearing shall be enclosed in the permanently hermetically sealed register. The drive magnet shall be located in the measuring element, and the follower magnet shall be located inside the permanently hermetically sealed register. An intermediate magnetically active material shall be required to distribute the magnetic flux uniformly to the follower magnet, thereby improving the service life of the register's rotating components.

G. All meters shall operate without leakage, damage or malfunction up to a maximum operating pressure of 150 pounds per square inch.

H. The 6-inch and 10-inch size meters shall have external strainers as part of the meter package. Strainers shall have cover plate for inspection and removal of debris from the bronze screen without disturbing the pipeline.

I. Flanges on 2-inch size meters shall be oval faced and drilled on the horizontal axis with a bolt circle diameter of 4 ½ -inch. Thickness shall be as required for Class 125 round flanges. Flanges for 3-inch, 4-inch, 6-inch and 10-inch size meters shall be of the Class 125 round type, flat faced, and shall conform to ANSI 16.1 for specified diameter, drilling and thickness. Companion flanges, if required with the meters, shall consist of one standard cast iron flange, tapped with American Standard internal taper pipe threads, and one flanged coupling adapter. The type and outside diameter of connecting pipe shall be provided for appropriate gasket sizing. All bolts, nuts and gaskets shall be provided.

J. Turbine meters of similar design concept must be available for purchase in all of the sizes specified above. The turbine meters must have a minimum of five (5) years of satisfactory operating experience as marketable products. Limited experimental history is not acceptable. The meter manufacturer shall submit, in writing, a price schedule of its factory maintenance program for the measuring chambers.

K. The water meter shall be fully field insulated and jacketed to prevent condensation.

L. The water meter shall be provided with a high frequency pulse output device for interface with Automatic Temperature Control System. The Infrared Pulser shall be Model 860 as manufactured by Hersey or approved equal.

M. A Pulse to DC converter shall be supplied with the Infrared Pulser. The device shall convert pulses from a variety of liquid flow sensing devices to a 4-20mA output signal which is proportional to the flow rate. This output shall transmit flow rate data over long distances with no loss of accuracy. The converter shall be Model 1005 as manufactured by Hersey or approved equal.

N. At contractor's option a water meter provided by the ATC subcontractor may be utilized.

2.13. DOMESTIC WATER EXPANSION TANKS

A. Provide and install domestic water expansion tanks of size, capacity and as indicated on contract drawings. Domestic water expansion tanks shall be Therm-X-TROL as manufactured by AMTROL Inc., Flexcon, Wessels, Taco, Armstrong, or approved equal. Mount tank as detailed on the drawings.

B. Domestic water expansion tanks shall be specifically designed for use in potable water systems. Tanks shall be pre-charged to require pressure at the factory. The maximum working pressure shall be 150 psig. The maximum operating temperature shall be 200 degrees F. Expansion tanks shall contain removable FDA approved butyl bladder.

C. Before installation, Contractor shall adjust the tank air pre-charge pressures to equal city water pressure.

D. The tank must be constructed in accordance with Section VIII of the A.S.M.E. boiler and pressure vessel code and stamped 150 psig working pressure.

E. Accessories: Pressure gauge and air charging fitting, tank drain, pre-charge as indicated on contract drawings and factory installed clip angles.

2.14. INTERIOR RECESSED WALL HYDRANTS

A. Provide and install recessed wall hydrants where indicated on the contract drawings. Recessed wall hydrants shall be Zurn Model Z 1330, Josam, Ancon, Mifab, Watts or approved equal.

B. Units shall be encased Ecotrol “anti-siphon" wall hydrant for interior wall installation.

C. Each unit shall be complete with integral backflow preventer, all bronze interior parts, non-turning operating coupling with hemispherical neoprene plunger and 3/4-inch solder inlet.

D. Furnish each unit mounted in a stainless steel box and hinged cover with operating key lock and "water" stamped on cover.

E. Furnish each unit with the following accessories:
   1. 3/4 inch – 90 degrees inlet elbow with union nut
   2. cylinder lock

3. key operator

2.15. ICE MAKER COLD WATER INLET FILTER

A. Provide and install a cartridge type water filter on the cold water inlet to the ice maker as detailed on the contract drawings. Housing shall be constructed of PVC with 3/4-inch NPT connections. Heads shall be cast bronze nickel plated with nickel plated "T" handle cap nut. Unit shall have pet cock bottom drain. Housing shall contain two (2) 20 micron cartridge filters. The entire filter assembly shall be rated for 150 psig. Unit shall be capable of handling a minimum 6 gpm. Housing shall be as manufactured by Keystone or approved equal.

B. Install filter housing to allow access for service and filter replacement.

PART 3. EXECUTION

3.01. GENERAL INSTALLATION REQUIREMENTS

A. Install all equipment in accordance with manufacturer's instructions.

B. Install components plumb and level.

C. Cleanouts in vertical pipes shall be installed in tees near floor. Cleanouts in horizontal pipes shall be installed with wyes on long sweep quarter beds. Cleanouts punching water proofing membranes shall have flashing clamps. Cleanout access covers in dry wall or gypsum board shall be painted to match walls.

D. Unless otherwise noted, drains are to be installed at the low point of floors. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

E. Install floor drains in low points so the top of grates are at or below the finished floor level.

F. Drains not functioning properly shall be removed and re-installed properly at the expense of the contractor.

G. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

H. Extend cleanouts to finish floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

I. Encase exterior cleanouts in concrete flush with grade.

J. Coordinate with plumbing piping and related electrical work to achieve a complete operating system.

K. Install domestic water storage tanks in accordance with manufacturer's instructions.

L. Provide painted steel pipe support for tanks independent of building structural framing members.

M. Clean and flush domestic water storage tanks after installation. Seal until pipe connections are made.

N. All plumbing, vents in exterior walls shall be offset a minimum of 3'-0" in ceiling at roof before penetration.

O. All plumbing vents within a 10'-0" radius of exhaust vents shall be extended to a height of 3'-0" above exhaust vent crown.

P. All plumbing vents within a 10'-0" radius of any rooftop unit or intake louver shall be extended to a height of 3'-0" above fresh air intake.

Q. Slopes and invert elevations of all interior piping shall be established before any piping is installed in order that proper slopes will be maintained. All piping shall be located and determined where to be run to avoid conflict with other trades.

R. Unless otherwise noted, all plumbing piping shall be routed as high as possible between bottom of roof joists and above ceiling to allow proper installation of ductwork, fire protection piping, conduits, etc.

S. Coordinate with Architectural Drawings before roughing in plumbing.

T. All openings in ceilings and plenum walls for plumbing shall be sealed air tight and protected with fire stop.

U. See site plan for extent of all piping leaving and entering building.

V. See domestic water riser diagrams for location of valves, shock absorbers, etc.

W. Make proper HW, CW, re-cir., waste, and vent connections to all equipment even though all branch main, elbows and connections are not shown.

X. Cleanouts shall be provided near base of each vertical waste or solid stack. Provide 18" minimum clearance for access.

Y. Unless otherwise noted, sanitary waste piping shown is below floor and all other piping is overhead, above ceiling. Domestic hot, cold and re-circ. water piping shall be installed between ceiling and roof insulation.

Z. Unless otherwise noted, horizontal sanitary piping pitches shall be 1 percent.

AA. Unless otherwise noted, all domestic water piping and limited area fire protection piping shall be installed on heated side of ceiling insulation.

BB. All piping and installation shall comply with all local and national plumbing codes. Test piping as required by plumbing code and authority having jurisdiction.

CC. For sizes of all domestic water piping see plumbing fixture schedule and domestic water riser diagrams.

DD. For sizes of all sanitary and vent piping see plumbing fixture schedule and sanitary/vent riser diagrams.

3.02. DOMESTIC WATER HEATER INSTALLATION REQUIREMENTS

A. Install units on concrete bases, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

B. Anchor units to substrate.

C. Install temperature and pressure relief valves in top portion of storage tank shells of units with storage. Use relief valves with sensing elements that extend into shells. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain. Install union on relief valve discharge piping. Install automatic air vent at top of hot water supply piping with union ball valve.

D. Install pressure relief valves in water piping for units without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

F. Install unit drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section, *Plumbing Piping, Fittings and Valves* for drain valves.

G. Install thermometers on unit inlet and outlet piping. Refer to Division 22 Section, *Plumbing Piping, Fitting and Valves* for thermometers. Install pressure gages on unit piping.

I. Fill unit with water. Install domestic water expansion tank and charge with air .Install piping adjacent to units to allow service and maintenance.

L. Connect hot- and cold-water piping with shutoff valves and unions. Connect hot-water-circulating piping with shutoff valve, check valve, and union.

M. Make connections with dielectric fittings where piping is made of dissimilar metal.

N. Electrical Connections: Power wiring is specified in Division 26 Sections. Arrange wiring to allow unit servicing.

O. Ground equipment

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.Engage a factory-authorized service representative to perform startup service.

Q. In addition to manufacturer's written installation and startup checks, perform the following:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment and retest until satisfactory results are achieved.
2. Verify that piping system tests are complete.
3. Check for piping connection leaks.
4. Check for clear relief valve inlets, outlets, and drain piping .Check operation of circulators.
6. Test operation of safety controls, relief valves, and devices. Energize electric circuits.
8. Adjust operating controls.
9. Adjust hot-water-outlet temperature settings. Do not set above 120 deg F unless piping system application requires higher temperature.

3.03. PLUMBING SPECIALTY INSTALLATION REQUIREMENTS

A. General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

B. Install backflow preventers of type, size, and capacity indicated, at each water-supply connection to mechanical equipment and systems, and to other equipment and water systems as indicated. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment. Install air-gap fitting on units with atmospheric-vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.

C. Field test all backflow preventers and submit test reports to Engineer. Furnish test kits as required for field testing.

D. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

E. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve, and where indicated.

F. Install hose bibbs with integral or field-installed vacuum breaker.

G. Install wall hydrants with integral or field-installed vacuum breaker.

H. All hose bibs shall be mounted 18" above finished floor, unless otherwise specified.

I. All wall hydrants shall be mounted 24" above finished grade unless otherwise specified.

J. Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of one percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow. Install trap priming stations plumb and level with adequate access for servicing and maintenance.

L. Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing. Fasten wall-hanging plumbing specialties

securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated. For exterior installation provide handhole with hinged cover and top mounted to be flush with grade.

N. Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

O. Secure supplies to supports or substrate.

P. Install individual stop valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve as appropriate is not indicated.

Q. Install water-supply stop valves in accessible locations.

R. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

S. Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

T. Install ball valves at all shock absorbers to allow removal for service/replacement.

3.04. WATER METER INSTALLATION REQUIREMENTS

A. Install water meters, piping, and specialties according to Manufacturer's requirements.

1. Install displacement-type water meters with shutoff valve on water meter inlet. Install valve on water meter outlet and valved bypass around meter, unless prohibited by authorities having jurisdiction.

2. Install compound-type water meters with shutoff valves on water meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.

B. Install power and control wiring from water meter to ATC system.

C. Field insulate and jacket water meter to prevent condensation.

3.05. FITTINGS FOR FIXTURES SUPPLIED BY OTHERS

A. Fixtures such as kitchen equipment are provided under other divisions of the specifications and are complete with strainer and tailpiece. Fittings, accessories and connection of these fixtures to the plumbing system are provided under this section.

B. Rough-in and final connection includes but is not limited to all domestic water, waste, and vent systems. Furnish stops, strainers, vacuum breakers, and under counter insulation where not furnished under another Division of these specifications.

3.06. TESTING

A. After plumbing fixtures are connected, all piping and fixtures shall be tested for operation

and a smoke or peppermint test shall be made on all soil, waste and vent piping.

B. After the building has been occupied and the various equipment is in actual use, the Contractor shall make an operating test of all equipment at a time directed by the Engineer to determine that all contract requirements are met.

3.07. CLEANING AND STERILIZATION

A. After final testing for leaks, all potable water lines shall be thoroughly flushed, by plumbing contractor, to remove foreign material. Before placing the systems in service, sterilize the new water lines in accordance with local health department codes and at a minimum according to the following procedure:

1. Through a 3/4-inch hose connection in each branch main and building main, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 ppm. Plumbing Contractor shall provide plumbing connections and power for pumping chlorine into system.

2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.

3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 ppm chlorine, retain this water in the system for at least three (3) hours.

4. CAUTION: Over-concentration of chlorine and more than three (3) hours of retention may result in damage to piping system. It is not necessary to retain chlorine in any system for twenty-four hours to achieve sterilization. AWWA states that 200 ppm chlorine for three hours is sufficient.

5. At the end of the retention period, no less than 100 ppm of chlorine shall be present at the extreme end of the system.

6. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 ppm.

7. Obtain representative water sample from the system for analysis by an independent and recognized bacteriological laboratory.

8. If the sample tested for coliform organisms is negative, a letter and laboratory report shall be submitted by the service organization to the Contractor, certifying successful completion of the sterilization. Additionally, this report shall be forwarded to the Owner as well as be included in the O&M Manual.

9. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.

10. Take precautions to avoid use of plumbing fixtures and domestic water systems during sterilization period. Place signs on all plumbing fixtures and outlets during sterilization period.

3.08. EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

3.09. PREPARATION

A. Confirm rough-in location and size of fixtures and openings prior to commencing work.

B. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.10. INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.11. CLEANING

A. At completion, clean plumbing equipment.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1. GENERAL

1.01. SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Provide all labor, materials, equipment, and services necessary for and incidental to the complete installation and operation of all mechanical work.

C. Unless otherwise specified, all submissions shall be made to, and acceptances and approvals made by the Architect and the Engineer.

D. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange piping, ductwork, equipment, and other work generally as shown on the contract drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with *Submittals* specified below. The right is reserved to make reasonable changes in location of equipment, piping, and ductwork, up to the time of rough-in or fabrication.

E. Conform to the requirements of all rules, regulations and codes of local, state and federal authorities having jurisdiction.

F. Coordinate the work under Division 23 with the work of all other construction trades.

G. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the contract documents.

1.02. PERMITS AND FEES

A. Obtain all permits and pay taxes, fees and other costs in connection with the work. File necessary plans, prepare documents, give proper notices and obtain necessary approvals. Deliver inspection and approval certificates to Owner prior to final acceptance of the work.

B. Permits and fees shall comply with the Division 01, *General Requirements* of the specification.

1.03. EXAMINATION OF SITE

A. Examine the site, determine all conditions and circumstances under which the work must be done, and make all necessary allowances for same. No additional cost to the Owner will be permitted for contractors' failure to do so.

B. Examine and verify specific conditions described in individual specifications sections.

C. Verify that utility services are available, of the correct characteristics, and in the correct locations.

1.04. CONTRACTOR QUALIFICATION

A. Any Contractor or Subcontractor performing work under Division 23 shall be fully qualified and acceptable to the Architect/Engineer and Owner. Submit the following evidence when requested:

1. A list of not less than five comparable projects which the Contractor completed.

2. Letter of reference from not less than three registered professional engineers, general contractors or building owners.

3. Local and/or State License, where required.

4. Membership in trade or professional organizations where required.

B. A Contractor is any individual, partnership, or corporation, performing work by contract or subcontract on this project.

C. Acceptance of a Contractor or Subcontractor will not relieve the Contractor or subcontractor of any contractual requirements or his responsibility to supervise and coordinate the work, of various trades.

1.05. MATERIALS AND EQUIPMENT

A. Materials and equipment installed as a permanent part of the project shall be new, unless otherwise indicated or specified, and of the specified type and quality.

B. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish named item, or its equal, subject to approval by Engineer. Substituted items shall be equal or better in quality and performance and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of substituted items, for approval.

C. The suitability of named item only has been verified. Where more than one item is named, only the first named item has been verified as suitable. Substituted items, including items other than first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement and application. Contractor, by providing other than the first named manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation. Adjustments and modifications shall include but not be limited to electrical, structural, support, and architectural work.

D. Substitution will not be permitted for specified items of material or equipment where noted.

E. All items of equipment furnished shall have a service record of at least five (5) years.

1.06. FIRE SAFE MATERIALS

A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA and ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

1.07. REFERENCED STANDARDS, CODES AND SPECIFICATIONS

A. Specifications, Codes and Standards listed below are included as part of this specification, latest edition.

B.	AABC	-	Associated Air Balance Council
C.	ADC	-	Air Diffusion Council
D.	AMCA	-	Air Movement and Control Association
E.	ANSI	-	American National Standards Institute
F.	ARI	-	Air Conditioning and Refrigeration Institute
G.	ASHRAE	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
H.	ASME	-	American Society of Mechanical Engineers
I.	ASPE	-	American Society of Plumbing Engineers
J.	ASTM	-	American Society for Testing and Materials
K.	DNREC	-	Delaware Department of Natural Resources
L.	IBC	-	International Building Code
M.	IEEE	-	Institute of Electrical and Electronics Engineers
N.	MSSP	-	Manufacturers Standards Society of the Valve and Fittings Industry
O.	NEC	-	National Electrical Code
P.	NEMA	-	National Electrical Manufacturers Association
Q.	NFPA	-	National Fire Protection Association
R.	SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association
S.	UL	-	Underwriters' Laboratories

T. All mechanical equipment and materials shall comply with the codes and standards listed in the latest edition of ASHRAE HVAC Applications Handbook, Chapter entitled *Codes and Standards*.

1.08. SHOP DRAWINGS

A. Prepare and submit shop drawings for all mechanical equipment, specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings, or where the proposed installation differs from that shown on contract drawings.

B. Submit data and shop drawings including but not limited to the list below, in addition to provisions of the paragraph above. Identify all shop drawings by the name of the item and system and the applicable specification paragraph number and drawing number.

C. Every submittal including, but not limited to the list below, shall be forwarded with its own transmittal as a separate, distinct shop drawing. Grouping of items/systems that are

not related shall be unacceptable.

D. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR 4.2): For products having recycled content, required documentations for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and Credit MR 5.2): For product manufactured, assembled or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

E. Items and Systems

Access Doors/Panels including layouts and locations
Air Distribution Systems
Automatic Temperature Control Systems and Equipment
Branch Selector Boxes
Condensate Pumps
Coordinated Drawings
Drip Pans
Duct Materials
Electric Unit Heaters
Energy Recovery Ventilators
Equipment Rails
Exterior Equipment and Piping Supports
Fans
Filters
Fire Stopping - Methods and Materials
Grilles, Registers, Diffusers
Identification Systems
Material and Equipment Lists
Operations and Maintenance Manuals
Pipe Materials Including Itemized Schedules
Preliminary Testing and Balancing Reports
Refnets
Roof Curbs
Test Certificates
Thermal Insulation Materials Include Table Summaries
Thermometers and Gauges
Variable Refrigerant Volume Equipment
Vibration Isolation Materials
Weatherproof Assembly Components
Wiring Diagrams, Flow Diagrams and Operating Instructions

F. Contractor, additionally, shall submit for review any other shop drawings as required by the Architect and/or Engineer. No item shall be delivered to the site, or installed, until the Contractor has received a submittal from the Engineer marked *Reviewed* or

Comments Noted. After the proposed materials have been reviewed, no substitution will be permitted except where approved by the Architect and/or Engineer.

G. For any shop drawing requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

1.09. CUTTING AND PATCHING

A. Accomplish all cutting and patching necessary for the installation of work under Division 23. Damage resulting from this work to other work already in place, shall be repaired at Contractor's expense. Where cutting is required, perform work in neat and workmanlike manner. Restore disturbed work to match and blend with existing construction and finish, using materials compatible with the original. Use mechanics skilled in the particular trades required.

B. Do not cut structural members without approval from the Architect or Engineer.

1.10. PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls, and interior waterproof construction. Where such penetrations are necessary, furnish and install all necessary curbs, sleeves, flashings, fittings and caulking to make penetrations absolutely watertight.

B. Where pipes penetrate roofs, flash pipe with Stoneman *Stormtite*, Pate or approved equal, roof flashing assemblies with skirt and caulked counter flashing sleeve.

C. Furnish and install pitch pockets or weather tight curb assemblies where required.

D. Furnish and install roof drains, curbs, vent assemblies, and duct sleeves specifically designed for application to the particular roof construction, and install in accordance with the manufacturer's instructions. The Contractor shall be responsible for sleeve sizes and locations. All roof penetrations shall be installed in accordance with manufacturer’s instructions, the National Roofing Contractors Association, SMACNA, and as required by other divisions of these specifications.

1.11. CONCRETE AND MASONRY WORK

A. Furnish and install concrete and masonry work for equipment foundations, supports, pads, and other items required under Division 23. Perform work in accordance with requirements of other applicable Divisions of these specifications.

B. Concrete shall test not less than 3,000 psi compressive strength after 28 days.

C. Grout shall be non-shrink, high strength mortar, free of iron of chlorides and suitable for use in contact with all metals, without caps or other protective finishes. Apply in accordance with manufacturer's instructions and standard grouting practices.

1.12. DRIVE GUARDS

A. Provide safety guards on all exposed belt drives, motor couplings, and other rotating machinery. Provide fully enclosed guards where machinery is exposed from more than one direction.

B. When available, guards shall be factory fabricated and furnished with the equipment. Otherwise fabricate guards of heavy gauge steel, rigidly braced, removable, and finish to match equipment served. Provide openings for tachometers. Guards shall meet local, State and O.S.H.A. requirements.

1.13. VIBRATION ISOLATION

A. Furnish and install vibration isolators, flexible connections, supports, anchors and/or foundations required to prevent transmission of vibration from equipment, piping or ductwork to building structure. See Division 23 Section, *Vibration Control for HVAC, Plumbing and Fire Protection Equipment.*

1.14. FASTENERS/CAPS

A. All fasteners located in public spaces including locker rooms, corridors, lobbies, toilet rooms, etc., shall be provided with tamper proof fasteners. Provide Pin Phillips hardware as manufactured by Challenge Industries or approved equal.

B. For all exterior equipment containing refrigerant install lockable caps on service valves to prevent tampering.

1.15. DEFINITIONS

A. *Approve* - to permit use of material, equipment or methods conditional upon compliance with contract documents requirements.

B. *Furnish and install* or *provide* means to supply, erect, install, and connect to complete for readiness for regular operation, the particular work referred to.

C. *Contractor* means the mechanical contractor and any of his subcontractors, vendors, suppliers, or fabricators.

D. *Piping* includes pipe, all fittings, valves, hangers, insulation, identification, and other accessories relative to such piping.

E. *Ductwork* includes duct material, fittings, hangers, insulation, sealant, identification and other accessories

F. *Concealed* means hidden from sight in chases, formed spaces, shafts, hung ceilings, embedded in construction or in crawl space or attic.

G. *Exposed* means not installed underground or *concealed* as defined above.

H. *Invert Elevation* means the elevation of the inside bottom of pipe.

I. *Finished Spaces*: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceiling, unexcavated spaces, crawl spaces, and tunnels.

J. *Review* - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

K. *Building Line:* Exterior wall of building.

1.16. MINIMUM EFFICIENCY REQUIREMENTS

A. All heating, ventilating, and air conditioning equipment shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

B. All piping, ductwork, and equipment insulation shall comply with ASHRAE Standard 90.1, latest edition.

C. All service water/heating equipment shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

D. All mechanical devices, controls, accessories, and components shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

1.17. SYSTEM INTEGRATION

A. For all HVAC equipment specified to be provided with packaged controls and interfaced with the automatic temperature control system, provide system integration between the equipment manufacturer and the automatic temperature control subcontractor.

B. HVAC equipment submittals requiring system integration as defined above must identify all required system integration points.

C. HVAC equipment manufacturers must coordinate with ATC subcontractor regarding system integration prior to submitting on the equipment.

D. A system integration meeting must be arranged by the Mechanical Contractor and include, but not be limited to the systems integrator for the HVAC equipment manufacturer and the ATC Subcontractor. This portion of systems integration must occur prior to HVAC equipment being delivered to the project.

E. Once the HVAC equipment is on site, a second systems integration meeting must be arranged by the Mechanical Contractor to coordinate the packaged controls with the ATC system. The HVAC equipment manufacturer's representative familiar with system integration and the ATC subcontractor familiar with programming must be present.

F. A final system integrations meeting shall occur once all equipment is in place and ready for operation. The Mechanical Contractor, the HVAC equipment systems' integrator, and the ATC Subcontractor shall meet on site to jointly program, schedule, verify points,

interlock devices, and fully set up all systems integration components.

G. All systems integration coordination, programming, and graphics must be completed prior to requesting commissioning and/or inspections by the Engineer of Record.

1.18. LEED REQUIREMENTS

A. Refer to Division 01 Section LEED Requirements for description of work under this Division affected by LEED requirements.

1.19. LEED SUBMITTALS

A. Product data for Credit EQ 4.1: For adhesives, welding solvents, and sealants applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.

B. Product data for Credit EQ 4.2: For paints, mastics, and coatings applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.

C. Product data for Credit EQ 4.4: For plywood backboards installed within the building water proofing envelope, documentation indicating no added urea formaldehyde resins.

D. Product data for Credit EQ 3: For filter media installed during construction and prior to occupancy, documentation indicating MERV rating.

PART 2. ELECTRICAL REQUIREMENTS

2.01. GENERAL MOTOR AND ELECTRICAL REQUIREMENTS

A. Furnish and install control and interlock wiring for the equipment furnished. In general, power wiring and motor starting equipment will be provided under Division 26. Carefully review the contract documents to coordinate the electrical work under Division 23 with the work under Division 26. Where the electrical requirements of the equipment furnished differ from the provisions made under Division 26, make the necessary allowances under Division 23. Where no electrical provisions are made under Division 26, include all necessary electrical work under Division 23.

B. All electrical work performed under Division 23 shall conform to the applicable requirements of Division 26 and conforming to the National Electric Code. All wiring, conduit, etc., installed in ceiling plenums must be plenum rated per NFPA & BOCA.

C. Provide wiring diagrams with electrical characteristics and connection requirements.

D. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than five (5) horsepower.

E. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

F. All motors shall be furnished with visible nameplate indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor and efficiency.

G. Motors located in exterior locations, wet air streams, air cooled condensers, and outdoors shall be totally enclosed weatherproof epoxy-treated type.

H. Nominal efficiency and power factor shall be as scheduled at full load and rated voltage when tested in accordance with IEEE 112.

I. Brake horsepower load requirement at specified duty shall not exceed 85 percent of nameplate horsepower times NEMA service factor for motors with 1.0 and 1.15 service factors.

J. All single phase motors shall be provided with thermal protection: Internal protection shall automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature ratings of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range, unless otherwise indicated.

2.02. MOTORS AND CONTROLS

A. Motors and controls shall conform to the latest requirements of IEEE, NEMA, NFPA-70 and shall be UL listed. Motor sizes are specified with the driven equipment. Motor starting and control equipment is specified either with the motor which is controlled or in an electrical specification section. The Contractor is advised to consult all specification sections to determine responsibility for motors and controls.

B. Motors shall be designed, built and tested in accordance with the latest revision of NEMA Standard MG l.

C. Motors shall be suitable for use under the conditions and with the equipment to which applied, and designed for operation on the electrical systems specified or indicated.

1. Motor capacities shall be such that the horsepower rating and the rated full-load current will not be exceeded while operating under the specified operating conditions. Under no condition shall the motor current exceed that indicated on the nameplates.

2. Motor sizes noted in the individual equipment specifications are minimum requirements only. It is the responsibility of the equipment manufacturers and of the Contractor to furnish motors, electrical circuits and equipment of ample capacity to operate the equipment without overloading, exceeding the rated full-load current, or overheating at full-load capacity under the most severe operating service of this equipment. Motors shall have sufficient torque to accelerate the total WR^2 of the driven equipment to operating speed.

3. Motors shall be continuous duty type and shall operate quietly at all speeds and loads.

4. Motors shall be designed for operation on 60 hertz power service. Unless

otherwise specified or shown, motors less than ½ horsepower shall be single phase, and motors ½ horsepower and larger shall be 3 phase unless otherwise noted.

5. Motors shall be mounted so that the motor can be removed without removing the entire driven unit.

D. Single phase motors, smaller than 1/20 horsepower shall be ball or sleeve bearing; drip-proof, totally enclosed or explosion proof, as specified; 120 volts; permanent-split capacitor or shaded pole type. These motors shall not be used for general power purposes, and shall only be provided as built-in components of such mechanical equipment as fans, unit heaters, and damper controllers. When approved by the Engineer, deviations from the specifications will be permitted as follows:

1. Open motors may be installed as part of an assembly where enclosure within a cabinet provides protection against moisture.

2. Motors used in conjunction with low voltage control systems may have a voltage rating less than 115 volts.

E. Single phase motors, greater than 1/20 horsepower and less than ½ horsepower shall be ball bearing; drip-proof, totally enclosed or explosion proof, as specified, with Class A or B insulation, as standard with the motor manufacturer; 115 or 120/208/240 volts as required; capacitor start-induction run, permanent split capacitor, or repulsion start-induction run type with minimum efficiency of 70 percent and a minimum full load power of 77 percent.

F. Except as otherwise specified in the various specification sections, 3 phase motors 60 horsepower and smaller shall be NEMA design B squirrel cage induction type meeting the requirements of this paragraph. Motors shall be drip-proof, totally enclosed or explosion proof, as specified or indicated. Insulation shall be Class B or F, at 40 degrees C ambient temperature. Drip-proof motors shall have a 1.15 service factor and totally enclosed and explosion proof motors shall have a service factor of 1.00 or higher. Motors specified for operation at 480, 240, and 208 volts shall be nameplated 460, 230, 200 volts, respectively. Efficiencies and percent power factor at full load for three phase motors shall be not less than the values listed below for premium efficiency motors:

MOTOR NAMEPLATE	MINIMUM PERCENT EFFICIENCY AT NOMINAL SPEED AND RATED LOAD	MINIMUM PERCENT POWER FACTOR
1HP and above to	85.5 percent	84 percent
1-½ HP	86.5 percent	85 percent
2HP	86.5 percent	85 percent
3HP	89.5 percent	86 percent
5HP	89.5 percent	87 percent

MOTOR NAMEPLATE	MINIMUM PERCENT EFFICIENCY AT NOMINAL SPEED AND RATED LOAD	MINIMUM PERCENT POWER FACTOR
7½ HP	91 percent	86 percent

G. Three phase motors ½ HP or greater shall be the Duty Master XE by Reliance Electric Company, Super-E Premium Efficiency of Baldor Motor and Drives, E-plus Efficient Standard Duty Motor of the Electric Motor Division of Gould, Inc., the MAC II High Efficiency motor of Westinghouse Electric Corp., the equivalent product of General Electric, or approved equal.

H. For motors serving equipment being controlled by a variable speed drive, motor shall be premium efficiency inverter duty rated.

I. Motor frames shall be NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast-iron or aluminum with steel inserts.

J. Control of each motor shall be manual or automatic as specified for each in the various mechanical sections. In general, and unless otherwise specified for a particular item in the various mechanical sections of the specifications, motor starters and controls shall be specified and provided under the various electrical sections of these specifications.

2.03. MOTOR INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors to support shaft regardless of shaft position.

C. Check line voltage and phase and ensure agreement with nameplate. Check that proper thermal overloads have been installed prior to operating motors.

D. Use adjustable motor mounting bases for belt-driven motors.

E. Align pulleys and install belts.

F. Tension belts according to manufacturer's written instructions.

2.04. WIRING DIAGRAMS

A. The Contractor is responsible for obtaining and submitting wiring diagrams for all major items of equipment.

B. Wiring diagrams shall be provided with shop drawings for all equipment requiring electric power.

C. Provide wiring diagrams for all major mechanical items of equipment to electrical contractor and ATC subcontractor for coordination.

PART 3. EXECUTION

3.01. EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the work are shown only in diagrammatic form. Refer conflicts to Architect and/or Engineer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.02. SUPPORTS, HANGERS AND FOUNDATIONS

A. Provide supports, hangers, braces, attachments and foundations required for the work. Support and set the work in a thoroughly substantial and workmanlike manner without placing strains on materials, equipment, or building structure, submit shop drawings for approval. Coordinate all work with the requirements of the structural division.

B. Supports, hangers, braces, and attachments shall be standard manufactured items or fabricated structural steel shapes. All interior hangers shall be galvanized or steel with rust inhibiting paint. For un-insulated copper piping provide copper hanger to prevent contact of dissimilar metals. All exterior hangers shall be constructed of stainless steel utilizing stainless steel rods, nuts, washers, bolts, etc.

3.03. PROVISIONS FOR ACCESS

A. The contractor shall provide access panels and doors for all concealed equipment, valves, dampers, filters, controls, control devices, cleanouts, fire dampers, damper operators, traps, and other devices requiring maintenance, service, adjustment, balancing or manual operation.

B. Where access doors are necessary, furnish and install manufactured painted steel door assemblies consisting of hinged door, key locks, and frame designed for the particular wall or ceiling construction. Properly locate each door. Door sizes shall be a 12 inches x 12 inches for hand access, 18 inches x 18 inches for shoulder access and 24 inches x 24 inches for full body access where required. Review locations and sizes with Architect prior to fabrication. Mark each access door within finished spaces with a small color coded and numbered tab. Provide a chart or index for identification. Provide U.L. approved and labeled access doors where installed in fire rated walls or ceilings. Doors

shall be Milcor Metal Access Doors as manufactured by Inland-Ryerson, Mifab, or approved equal.

1. Acoustical or Cement Plaster: Style B
2. Hard Finish Plaster: Style K or L
3. Masonry or Dry Wall: Style M

C. Where access is by means of liftout ceiling tiles or panels, mark each ceiling grid using small color-coded and numbered tabs. Provide a chart or index for identification. Place markers within ceiling grid not on ceiling tiles.

D. Access panels, doors, etc. described herein shall be furnished under the section of specifications providing the particular service and to be turned over to the pertinent trade for installation. Coordinate installation with installing contractor. All access doors shall be painted in baked enamel finish to match ceiling or wall finish.

E. Submit shop drawings indicating the proposed location of all access panels/doors. Access doors in finished spaces shall be coordinated with air devices, and lighting to provide a neat and symmetrical appearance.

3.04. PAINTING AND FINISHES

A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc. shall be stainless steel.

B. Clean surfaces prior to application of insulation, adhesives, coatings, paint, or other finishes.

C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pretreatment.

D. Protect all finishes and restore any finishes damaged as a result of work under Division 23 to their original condition.

E. The preceding requirements apply to all work, whether exposed or concealed.

F. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces. Do not paint manufacturer's labels or tags.

G. All exposed ductwork, piping, equipment, etc. shall be painted. Colors shall be as stated in this division or as selected by the Architect and/or Owner and conform to ANSI Standards.

H. All exterior roof mounted ductwork, equipment, piping, breeching, and vents shall be painted to match roof in color as selected by Architect and/or Owner.

I. All exposed ductwork, piping, equipment, etc. in finished spaces shall be painted. Colors shall be as selected by the Architect and conform to ANSI Standards.

J. All exposed ductwork, piping, equipment, etc., in mechanical rooms, utility rooms, janitor's closets, and storage where PVC jacketed shall not require painting. Label and identify and color code as specified.

3.05. CLEANING OF SYSTEMS

A. Clean fans, ductwork, enclosures, flues, registers, grilles, and diffusers at completion of work.

B. Install filters of equal efficiency to those specified in permanent air systems operated for temporary heating during construction. Replace with clean filters as specified prior to acceptance and after cleaning of system.

C. Pay for labor and materials required to locate and remove obstructions from systems that are clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.

D. Leave systems clean, and in complete running order.

3.06. COLOR SELECTION

A. Color of finishes shall be as selected by the Architect.

B. Submit color of factory-finished equipment for acceptance prior to ordering.

3.07. PROTECTION OF WORK

A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.

B. Cover temporary openings in piping, ductwork, and equipment to prevent the entrance of water, dirt, debris, or other foreign matter. Deliver pipes and tubes with factory applied end caps.

C. Cover or otherwise protect all finishes.

D. Replace damaged materials, devices, finishes and equipment.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, where stored inside.

3.08. OPERATION OF EQUIPMENT

A. Clean all systems and equipment prior to initial operation for testing, balancing, or other purposes. Lubricate, adjust, and test all equipment in accordance with manufacturer's instructions. Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.

B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment. Where factory start-

up of equipment is not specified, provide field start-up by qualified technician.

C. Submit factory start-up sheets or field start-ups sheets for all equipment prior to the commencement of testing and balancing work. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

D. Do not use mechanical systems for temporary services or temporary conditioning during construction, unless approved by Owner in writing. Refer to Division 01 Section *"Temporary Facilities and Controls"* for temporary heating/cooling during construction.

E. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items such as filters.

3.09. DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a videographer to record demonstration and training video recordings. Record each training module separately.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Engineer

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

3.10. IDENTIFICATIONS, FLOW DIAGRAMS, ELECTRICAL DIAGRAMS AND OPERATING INSTRUCTIONS

A. Contractor shall submit for approval schematic piping diagrams of each piping system installed in the building. Diagrams shall indicate the location and the identification number of each valve in the particular system. Following approval by all authorities, the diagrams shall be framed, mounted under safety glass and hung in each Mechanical Room where directed. Contractor shall deliver the tracing or sepia from which the diagrams were reproduced to the Owner.

B. All valves shall be plainly tagged. For any bypass valves, install sign indicating valve position as “Normally Open” or “Normally Closed” as required.

C. All items of equipment, including motor starters, disconnects and ATC panels shall be furnished with white on black plastic permanent identification cards. Lettering shall be a minimum of ¼ inch high. Identification plates shall be secured, affixed to each piece of equipment, starters, disconnects, panels by screw or adhesive (tuff bond #TB2 or as

approved equal).

D. Provide three (3) copies of operating and maintenance instructions for all principal items of equipment furnished. This material shall be bound as a volume of the *Record and Information Booklet* as hereinafter specified.

E. All lines piping and ductwork installed under this contract shall be stenciled with *direction of flow* arrows and with stenciled letters naming each pipe and ductwork and service. Refer to Division 23 Section, *HVAC Piping, Fittings, Valves, Etc.* and Division 23 Section, *HVAC Air Distribution*. Color-code all direction of flow arrows and labels. In finished spaces omit labeling and direction of flow arrows. Paint in color as selected by Architect.

F. Submit list of wording, symbols, letter size, and color coding for mechanical identification. Submit samples of equipment identification cards, piping labels, ductwork labels, and valve tags to Engineer for review prior to installation.

G. Provide at least 8 hours of straight time instruction to the operating personnel. Time of instruction shall be designated by the Owner. Additional instruction time for the automatic temperature control (ATC) system is specified in Division 23 Section, *Instrumentation & Controls of HVAC & Plumbing Systems*.

H. Contractor shall demonstrate Sequences of Operation of all equipment in presence of Owner's representative, Commissioning Authority (CxA), and ATC subcontractor.

3.11. WALL AND FLOOR PENETRATION

A. All penetrations of partitions, ceilings, roofs and floors by ducts, piping or conduit under Division 23 shall be sleeved, sealed, and caulked airtight for sound and air transfer control. Penetrations of mechanical room partitions, ceilings, and floors shall be as specified in Division 23 Section, *Vibration Control for HVAC, Plumbing and Fire Protection Equipment.*

B. All penetration of fire rated assemblies shall be sleeved, sealed, caulked and protected to maintain the rating of the wall, roof, or floor. Fire Marshal approved U.L. assemblies shall be utilized. See Division 07 Section, *HVAC & Plumbing Penetration Firestopping.*

C. Where piping extends through exterior walls or below grade, provide waterproof pipe penetration seals, as specified in another division of these specifications.

D. Provide pipe escutcheons and duct flanges for sleeved pipes and ducts in finished areas.

E. Piping sleeves:

1. Galvanized steel pipe, standard weight where pipes are exposed and roofs and concrete and masonry walls. On exterior walls provide anchor flange welded to perimeter.

2. Twenty-two (22) gauge galvanized steel elsewhere.

F. Ductwork sleeves: 20 gauge galvanized steel.

3.12. RECORD DRAWINGS

A. Upon completion of the mechanical installations, the Contractor shall deliver to the Architect and/or Engineer one complete set of prints of the mechanical contract drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings.

B. Contractor shall incorporate all sketches, addendums, value engineering, change orders, etc., into record drawings prior to delivering to Architect.

3.13. WARRANTY

A. Contractor's attention is directed to warranty obligations contained in the GENERAL CONDITIONS.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of equipment manufacturer’s warranties shall be included in the operations and maintenance manuals.

C. The Contractor guarantees for a two year period from the time of final acceptance by the Owner.

1. That the work contains no faulty or imperfect material or equipment or any imperfect, careless, or unskilled workmanship.

2. That all work, equipment, machines, devices, etc. shall be adequate for the use to which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.

3. That the contractor will re-execute, correct, repair, or remove and replace with proper work, without cost to the Owner, any work found to be deficient. The contractor shall also make good all damages caused to their work or materials in the process of complying with this section.

4. That the entire work shall be water-tight and leak-proof.

3.14. LUBRICATION

A. All bearings, motors, and all equipment requiring lubrication shall be provided with accessible fittings for same. Before turning over the equipment to the Owner, the Contractor shall fully lubricate each item of equipment, shall provide one year's supply of lubricant for each, and shall provide Owner with complete written lubricating instructions, together with diagram locating the points requiring lubrication. Include this information in the Record and Information Booklet.

B. In general, all motors and equipment shall be provided with grease lubricated roller or ball bearings with Alemite or equal accessible or extended grease fittings and drain plugs.

3.15. OPERATIONS AND MAINTENANCE MANUALS

A. The Contractor shall have prepared six (6) copies of the Record and Information Booklet and deliver these copies of the booklet to the Owner. The booklet shall be as specified herein. The booklet must be approved and will not be accepted as final until so stamped.

B. The booklet shall be bound in a three-ring loose-leaf binder similar to National No. 3881 with the following title lettered on the front: *Operations and Maintenance Manuals – Dover High School Outbuildings – Bid Pack G - HVAC.* No sheets larger than 8-1/2 inches x 11 inches shall be used, except sheets that are neatly folded to 8-1/2 inches x 11 inches and used as a pull-out. Provide divider tabs and table of contents for organizing and separating information.

C. Provide the following data in the booklet:

1. As first entry, an approved letter indicating the starting/ending time of Contractor's warranty period.
2. Maintenance operation and lubrication instructions on each piece of equipment furnished.
3. Complete catalog data on each piece of heating and air conditioning equipment furnished including approved shop drawing.
4. Manufacturer's extended limited warranties on equipment including but not limited to air conditioning compressors, and heat pumps.
5. Chart form indicating frequency and type of routine maintenance for all mechanical equipment. The chart shall also indicate model number of equipment, location and service.
6. Provide sales and authorized service representatives names, address, and phone numbers of all equipment and subcontractors.
7. Provide supplier and subcontractor's names, address, and phone number.
8. Catalog data of all equipment, valves, etc. shall include wiring diagrams, parts list and assembly drawing.
9. Provide and install in locations as directed by the Owner, valve charts including valve tag number, valve type, valve model number, valve manufacturer, style, service and location. Each valve chart shall be enclosed in a durable polymer based frame with a cover safety glass.
10. Copy of the approved balancing report including duct leakage data.
11. ATC systems including as-built ATC drawings of systems including internal of all panels.
12. Access panel charts with index illustrating the location and purpose of access panels.
13. Approved Health, and Electrical Certificates.
14. Start-up reports for equipment.
15. Provide and install in locations as directed by Owner, filter charts, including filter type, size, model number, manufacturer, quantity and size for each filter utilized on the project. Filter charts shall be enclosed in a durable polymer based frame with a cover safety glass.
16. Insert color graphic with embedded parameters for ATC system into record and information booklet.
17. Filter charts indicating equipment served, size, and type of filter required.

D. Submit Record and Information Booklets prior to anticipated date of substantial completion for Engineer review and approval. Substantial completion requires that

Record and Information booklets be reviewed and approved.

3.16. INSTALLATION AND COORDINATION DRAWINGS

A. Prepare, submit, and use composite installation and coordination drawings to assure proper coordination and installation of work. Drawings shall include, but not be limited, to the following:

1. Complete Ductwork, Plumbing, and HVAC Piping Drawings showing coordination with lights, electrical equipment, HVAC equipment and structural amenities.

B. Draw plans to a scale not less than 3/8-inch equals one foot. Include plans, sections, and elevations of proposed work, showing all equipment, piping and ductwork in areas involved. Fully dimension all work including lighting fixtures, conduits, pullboxes, panelboards, and other electrical work, walls, doors, ceilings, columns, beams, joists and other architectural and structural work.

C. Identify all equipment and devices on wiring diagrams and schematics. Where field connections are shown to factory-wired terminals, include manufacturer's literature showing internal wiring.

D. Refer to Division 01 Section "*Project Management and Coordination*" for additional requirements related to coordination drawings.

3.17. PIPING SYSTEMS TESTING

A. The entire new HVAC piping systems shall be tested hydrostatically before insulation covering is applied and proven tight under the following gauge pressures for a duration of four (4) hours. Testing to be witnessed by Owner's representative and documented in writing.

SYSTEM	TEST PRESSURE
Refrigerant Piping	400 psig with Nitrogen

B. Ductwork pressure testing shall be as specified in another division of these specifications.

C. Testing and acceptance thereof shall be in accordance with local requirements and shall meet approval of authority having jurisdiction. Submit certificates and approved permits and insert one (1) copy in the *Operations and Maintenance Manuals*.

D. Refrigerant piping shall be tested utilizing nitrogen per equipment manufacturer's requirements.

3.18. EQUIPMENT BY OTHERS

A. This Contractor shall make all system connections required to equipment furnished and installed under other divisions or furnished by the Owner. Connections shall be complete in all respects to render this equipment functional to its fullest intent.

B. It shall be the responsibility of the supplier of this equipment to furnish complete instructions for connections. Failure to do so will not relieve this contractor of any responsibility for improper equipment operation.

3.19. ADDITIONAL FILTERS AND BELTS

A. One complete set of additional filters and belts shall be turned over to the owner upon final acceptance of the building by the owner. Provide correspondence to the Engineer (copy) documenting that additional filters and belts have been turned over to Owner.

B. All filters and belts shall be tagged and identified for equipment served. Furnish filters in protection wrap.

END OF SECTION

SECTION 23 05 05

HVAC PIPING, FITTINGS AND VALVES

PART 1. GENERAL

1.01. SUMMARY

A. The conditions of the contract and other general requirements apply to the work specified in this section. All work under this section shall also be subject to the requirements of Division 23 Section, *Common Work Results for HVAC* and Division 01, *General Requirements*.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02. RELATED DOCUMENTS

A. This project is to be LEED certified. Refer to Division 01 Sections, including "Sustainable Design Requirements", "Construction Waste Managements", and "Commissioning Requirements" for mandatory work which may apply to all contractors, installers, and suppliers.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.03. SYSTEM DESCRIPTION CONDITIONS

A. Provide all labor and materials necessary to furnish and install all piping systems on this project as herein specified and/or shown on the drawings. Final connections to equipment furnished in other sections of the specifications shall be included under this section.

B. All piping and insulation installed in ceiling plenums must be plenum rated and comply with NFPA and International Building Code (IBC).

C. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

D. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus

connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

E. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

F. Provide pipe hangers and supports in accordance with ASTM B31.9 and MSS SP69 unless indicated otherwise.

1.04. QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

1.05. DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under as hereinbefore specified.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed systems.

1.06. ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

1.07. LEED REQUIREMENTS

A. Refer to Division 01 Section “LEED Requirements” for description of work under this Division affected by LEED requirements.

1.08. LEED SUBMITTALS

A. Product data for Credit EQ 4.1: For adhesives, welding solvents and sealants applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.

PART 2. PRODUCTS

2.01. PIPE MATERIALS

A. All materials, unless otherwise specified, shall be new and of the best quality of their respective kinds, and shall conform to the requirements and ordinances of local, state and insurance authorities having jurisdiction.

1. Refrigeration Piping:

a). Tube Size ¾ -inch & Smaller:

ASTM B280, copper tube; Type ACR, soft annealed temper fittings; cast copper-alloy fittings for flared copper tubes; flared joints. Fittings shall be ASME B16.22, wrought copper. Joints shall be bronzed, AWS A5.8, BCUP silver/phosphorous/copper alloy with melting range 1190 to 1480 degrees F.

b). Tube Size 7/8 inch through 4-1/8inches:

Copper tube, Type ACR, soft annealed temper; wrought-copper, solder-joint fittings; solder joints.

c). Soldered Joints: Solder joints using silver-lead solder, ASTM B 32, Grade 96 TS.

d). Brazed Joints: Braze joints using American Welding Society (AWS) classification BCuP-4 for brazing filler metal.

e). Flexible connectors: 500-psig (3450-kPa) minimum operating pressure; stainless-steel core and high-tensile stainless-steel-braid covering; dehydrated, pressure tested, minimum 7 inches (180 mm) long.

f). Diaphragm Packless Valves:
500-psig (3450-kPa) working pressure and 275 degrees Fahrenheit (135 degrees C) working temperature; globe design with straight-through or angle pattern; forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, and with solder-end connections.

g). Packed-Angle Valves: 500-psig (3450-kPa) working pressure and 275 degrees Fahrenheit (135 degrees C) working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.

h). Check Valves: Smaller than NPS 1 (DN 25): 400-psig (2760-kPa) operating pressure and 285 degrees Fahrenheit (141 deg Celsius) operating temperature; cast-brass body, with removable piston, polytetrafluoroethylene seat, and stainless-steel spring; globe design. Valve shall be straight-through pattern, with solder-end connections.

i). Check Valves: NPS 1 (DN 25) and Larger: 400-psig (2760-kPa) operating pressure and 285 degrees Fahrenheit (141 deg Celsius) operating temperature; cast-bronze body, with cast-bronze or forged-brass bolted bonnet; floating piston with mechanically retained polytetrafluoroethylene seat disc. Valve shall be straight-through or angle pattern, with solder-end connections.

j). Service Valves: 500-psig (3450-kPa) pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.

k). Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.

2. Cooling Coil A/C Condensate Drain Piping:

a). Pipe & Fittings: All A/C condensate drain piping shall be constructed of Type *L* copper tubing, with sweat fittings made with 95-5 solder. Washout plugs (cleanouts) shall be strategically located to allow periodic flush out of system. At a minimum, provide washout plugs at equipment connections and at direction changes of 90 degrees F or greater.

B. Copper pipe shall be Revere, Anaconda or Chase with approved solder fittings.

2.02. PIPE HANGERS, ROLLER SUPPORTS, ANCHORS, GUIDES, AND SADDLES

A. All hangers for metallic piping shall be adjustable, wrought clevis type, or adjustable malleable split ring swivel type, having rods with machine threads. Hangers shall be Grinnell Company's Figure 260 for pipe ¾-inch and larger, and Figure 65 for pipe 2-inches and smaller, or approved equal. Adjustable pipe stanchion with U-bolt shall be Grinnell Company's Figure 191. Pipe roller supports shall be Grinnell's Figure 181 or Figure 271. Exterior pipe hangers shall be galvanized or stainless steel construction. For copper piping in direct contact with the hanger, hanger construction shall be copper coated to prevent contact of dissimilar metals similar to Grinnell's Figure CT-65. Hanger spacing and rod sizes for steel and copper pipe shall not be less than the following:

NOMINAL PIPE SIZE IN	STD. STEEL PIPE	MAXIMUM SPAN FT. COPPER TUBE	MINIMUM ROD DIAMETER INCHES OF ASTM A36 STEEL THREADED RODS
3/4 & 1	6	5	3/8
1 - ½	6	8	3/8
2	8	8	3/8

B. Anchors, guides, and roller supports shall be installed in accordance with the contract drawings and manufacturer's recommendations to provide pipe support and control pipe movement for all piping systems. Anchors and guides shall be securely attached to the pipe support structure. Submit shop drawing for proposed pipe support structure for guides and anchors for approval of the Structural Engineer. Pipe alignment guides shall be Fig. 255 Grinnell, or as approved equal. Guides shall be sized to accommodate the pipe with insulation. Guides shall be steel factory, fabricated, with bolted two section outer cylinder

and base for alignment of piping and two section guiding spider for bolting to pipe.

C. Hangers for pipe sizes ½ to 1 ½ inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.

D. Hangers for cold pipe sizes 2 inches (50 mm) and over: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze hangers: Steel channels with welded spacers and hanger rods.

F. Vertical Support: Steel riser clamp.

G. Floor support for cold pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper pipe support: Carbon steel ring, adjustable, copper plated.

I. Hanger rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.03. VALVES

A. Provide parts list and assembly drawings (exploded view) for all valves in shop drawing submittals. Provide valves of the same type by the same manufacturer.

2.04. UNIONS, FLANGES, AND COUPLINGS

A. Unions in copper pipe 2-inches and smaller shall be sweat fittings with bronze seats designed for a working pressure of 125 psig.

B. Flanges for copper pipe over 2 inches shall be bronze. Gaskets shall be 1/16 inch thick preformed neoprene.

2.05. ESCUTCHEONS

A. Provide chromium plated escutcheons properly fitted and secured with set screws on all exposed piping which passes through walls, floors or ceilings of finished spaces.

B. All escutcheon plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface. Plastic escutcheon plates will not be accepted.

2.06. SLEEVES

A. Sleeves shall be provided around all pipes through walls, floors, ceilings, partitions, roof structure members or other building parts. Sleeves shall be standard weight galvanized iron pipe two sizes larger than the pipe or insulation so that pipe or insulation shall pass through masonry or concrete walls or floors. Provide 20 gauge galvanized steel sheet or galvanized pipe sleeves for all piping passing through frame walls.

B. Space between the pipe and sleeve shall be caulked. Escutcheon plates shall be constructed to conceal the ends of sleeves. Each trade shall be responsible for drilling existing floors and walls for necessary sleeve holes. Drilling methods and tools shall be as hereinbefore

specified.

C. Sleeves through walls and floors shall be sealed with a waterproof caulking compound.

D. Firestop at sleeves that penetrate smoke barriers smoke partitions and/or rated walls/floors.

PART 3. EXECUTION

3.01. GENERAL PIPING INSTALLATION REQUIREMENTS

A. All piping shall be run to provide a minimum clearance of 2-inches between finished covering on such piping and all adjacent work. Group piping wherever practical at common elevations.

B. All valves, strainers, caps, and other fittings shall be readily accessible.

C. Spring clamp plates (escutcheons) shall be provided where pipes are exposed in the building and run through walls, floors, or ceilings. Plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface.

D. If the size of any piping is not clearly evident in the drawings, the Contractor shall request instructions for the Engineer as to the proper sizing. Any changes resulting from the Contractor's failure to request clarification shall be at his expense. Where pipe size discrepancies or conflicts exist in the drawings, the larger pipe size shall govern.

E. Where pipe support members are welded to structural building framing, scrape, brush clean, weld and apply one coat of zinc rich primer.

F. Provide clearance for installation of insulation and access to valves and fittings.

G. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.02. VALVE INSTALLATION REQUIREMENTS

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material

composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

G. Install valves as indicated, according to manufacturer's written instructions.

H. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

I. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

J. Locate valves for easy access and provide separate support where necessary.

K. Install valves in horizontal piping with stem at or above the center of the pipe.

L. Install valves in a position to allow full stem movement.

3.03. REFRIGERANT PIPING AND ACCESSORIES INSTALLATION REQUIREMENTS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater tan system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or

panels as specified if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

M. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

P. Identify refrigerant piping and valves.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section, “Common Work Results for HVAC”.

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section, “Common Work Results for HVAC”.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section, “Common Work Results for HVAC”.

T. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

U. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS ½ (DN 15): Maximum span, 60 inches (1500mm); minimum rod size, ¼ inch (6.4mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500mm); minimum rod size, ¼ inch (6.4mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800mm); minimum rod size, ¼ inch (6.4mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400mm); minimum rod size, 3/8 inch (9.5mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400mm); minimum rod size, 3/8 inch (9.5mm).
6. NPS 2 (DN 50): Maximum span, 96 inches (2400mm); minimum rod size, 3/8 inch (9.5mm).
7. NPS 2-½ (DN 65): Maximum span, 108 inches (2700mm); minimum rod size, 3/8 inch (9.5mm).
8. NPS 3 (DN 80): Maximum span, 10 feet (3m); minimum rod size, 3/8 inch (9.5mm).
9. NPS 4 (DN 100): Maximum span, 12 feet (3.7m); minimum rod size, 1/2 inch (13mm).

V. Support multifloor vertical runs at least at each floor.

W. Furnish and install complete refrigerant piping systems between the indoor units and outdoor units. Support piping in accordance with Division 23 Section, *HVAC Piping, Fittings, Valves, Etc.* Piping shall be sized as recommended by unit manufacturer taking into account length of vertical and horizontal runs, and refrigerant type. Provide and install dual sets of refrigerant piping on all units required to have dual independent circuits.

X. Furnish and install all required piping accessories including, but not limited to, thermal expansion valves, Sporlan, or approved equal; Packless isolation valves at condenser and evaporator coil, Henry or approved equal, charging valve with chained seal cap, Henry or approved equal, sight glasses, Henry or approved equal; filter dryer with replaceable cartridge, sporland, or approved equal, liquid line solenoid valve l20V/1/60 Hz., Sporlan, or approved equal. Contractor shall provide traps and double suction risers if required by equipment manufacturer. Pitch piping for proper oil return. Submit shop drawings on all components, and piping arrangements.

Y. All accessories shall be ARI rated. Furnish required nitrogen and refrigerant to fully test and charge system. Flood piping system with nitrogen when brazing.

Z. Refrigerant piping shall be Type 1 hard temper (ACR) copper tubing with wrought copper colder fittings. Make joints with silver solder and non-corrosive flux.

AA. Refrigerant piping shall be cleaned, dehydrated and evacuated. Piping shall be evacuated and held to less than 2.5 mm Hg vacuum for a period of not less than 12 hours without appreciable pressure rise. Vacuum shall then be broken with refrigerant or dry nitrogen and re-evacuated to 2.5 mm Hg vacuum for an additional 12 hours. Piping test to be witnessed by Owner's representative and documented in writing. Submit results of tests to Architect/Engineer.

BB. All refrigerant/suction lines sets shall be fully insulated. Exterior pipe insulation shall be fully jacketed as specified in Division 23 Section, *HVAC Insulation*.

CC. Follow ASHRAE 15, latest edition procedures for charging and purging of systems and for disposal of refrigerant.

DD. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

EE. Fully charge completed system with refrigerant after tested.

FF. Install liquid indicators in liquid line leaving condenser, in liquid line leaving, and on leaving side of liquid solenoid valves.

GG. Install strainers immediately upstream from each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.

HH. Install strainers in main liquid line where multiple expansion valves with integral strainers are used.

II. Install strainers in suction line of steel pipe.

JJ. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

KK. Install flexible connectors at or near compressors where piping configuration does not absorb vibration.

LL. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.

1. Test refrigerant piping, and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.

    a). System shall maintain test pressure at the manifold gage throughout duration of test.
    b). Test joints and fittings by brushing a small amount of soap and glycerin solution over joint.
    c). Fill system with nitrogen to raise a test pressure of 400 psig (1035 kPa) or higher as required by authorities having jurisdiction.
    d). Remake leaking joints using new materials, and retest until satisfactory results are achieved.

MM. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

NN. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

OO. Adjust set-point temperature of the conditioned air or chilled-water controllers to the system design temperature.

PP. Perform the following adjustments before operating the refrigeration system, according to

manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.

2. Check compressor oil level above center of sight glass.

3. Open compressor suction and discharge valves.

4. Open refrigerant valves, except bypass valves that are used for other purposes.

5. Check compressor-motor alignment, and lubricate motors and bearings.

QQ. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.

RR. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

SS. Charge system using the following procedures:

1. Install core in filter-dryer after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.

3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).

4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

3.04. PIPE JOINTS INSTALLATION REQUIREMENTS

A. Soldered Joints and Copper Piping: Joints in copper piping shall conform to the following minimum standards.

1. The pipes shall be cut to a length making certain that the ends are square, using a fins hacksaw blade or tube cutter. The ends of all pipes shall be reamed and all burrs removed.

2. The outside end of the pipe and the cut end of the fitting shall be cleaned with steel wool, sand cloth, or steel wire brush. All dark spots shall be removed.

3. The flux shall be applied evenly and sparingly to the outside end of the pipe and the inside of the outer end of the fitting until all surfaces to be jointed are completely covered. The piping and fitting shall be slipped together and reworked several times to insure an even distribution of the flux.

4. The correct amount of solder per joint for each size pipe shall be used in accordance with the manufacturer's recommendations.

5. Solder joints shall be made by using a direct flame from a torch.

6. On pipe sizes larger than ¼-inch, the fittings and valves in the pipe shall be moved or tapped with a hammer when the solder starts to melt to insure an even distribution of the solder.

7. The excess solder shall be removed while it is still in the plastic state leaving a fillet around the cup of the fitting.

8. Solder joints shall be suitable for working pressure of 100 psig and for working temperature of not less than 250 degrees F. The type of solder and flux used will be submitted for approval. Type 95-5 shall be the minimum standard.

9. Lead and antimony-based solders shall not be used for potable water systems. Brazing and silver solders are acceptable.

B. Where copper piping joins steel piping, approved bronze adapters shall be used.

C. Prohibited Connections: No direct weld, soldered, or brazed connections, without unions or flanges, shall be made to valves, strainers, apparatus, or related equipment. Right and left couplings, long threads, or caulking of pipe threads or gasket joints will not be permitted.

3.05. HANGERS INSTALLATION REQUIREMENTS

A. General: All hangers shall be of an approved type arranged to maintain the required grading and pitching of lines to prevent vibration and to provide for expansion and contraction. Provide protection saddles between hangers and insulation on heating water insulated pipe. Saddles shall be Grinnells Figure 173/273 or approved equal. Provide approved spacers between saddles and pipe where flexible insulation is specified. Provide insulation protection shields for insulated piping without saddles. Shield shall be Grinnell Figure 167 or as approved equal.

B. Spacing: Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.

C. Vertical Lines: Shall be supported at their bases, using either a suitable hanger placed in a horizontal line near the riser, or a base type fitting set on a pedestal, foundation or support. All vertical lines extending through more than one floor level shall be supported at each floor with a riser clamp. Riser clamp shall be Grinnell Co.'s Figure 261, or approved equal. All vertical drops to pump suction elbows shall be supported by floor posts.

D. Racks and Brackets: All horizontal piping on vertical walls shall be properly supported by suitable racks securely anchored into the wall construction. Where not practical to obtain ceiling anchorage, all piping near walls shall be supported by approved brackets securely anchored into the wall construction. Washer plates (Fib. 60, 60L) and other miscellaneous attachments, fasteners, etc., shall be Grinnell or as approved equal. All exterior hanger and bracket systems in their entirety shall be galvanized.

E. Pipe Hangers and supports shall be attached to the panel point at the top chord of bar joist or

at a location approved by the structural engineer.

F. Select hangers and components for loads imposed. Secure rods with double nuts.

G. Support of horizontal piping shall allow for vertical adjustment after installation of piping.

H. Support overhead piping with clevis hangers.

I. Do not support all parallel piping from the same joist. Stagger all supports in accordance with the structural engineer's recommendations.

J. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

K. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.

L. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.

M. Install pipe anchors according to expansion fitting manufacturer's written instructions if expansion fittings are indicated.

N. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

O. Refer to structural documents for appropriate connection/attachment materials to building.

3.06. PIPING IDENTIFICATION INSTALLATION

A. All piping shall be identified with painted background marked with the name of the service with arrows to indicate flow direction. Color code and system identification shall comply with ANSI Standards and piping identification system shall comply with ASME A13.1-81., scheme for the identification of piping systems and ASHRAE Fundamentals Handbook, latest edition.

B. Markings shall be plain block letters, stenciled on pipes, and shall be located near each branch connection, near each valve, and at least every 10 feet on straight runs of pipe. Where pipes are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such manner as to be easily legible from the floor. Pipe identification schedule shall be as follows:

OUTSIDE DIAMETER OF PIPE OR COVERING (INCHES)	LENGTH OF COLOR FIELD (INCHES)	SIZE OF LETTERS (INCHES)
½ to 1 ¼	8	½
1-½ to 2	8	¾
2 ½ to 6	12	1 ¼

8 to 10	24	2 ½
Over 10	32	3 ½

3.07. VALVE IDENTIFICATION

A. All valves shall be tagged with a numbered tag.

B. The tags shall be made of 1-inch diameter brass tags fastened to the valve by means of brass chains. Numbers shall agree with valve numbers on diagrammatic herein before specified.

C. Provide a minimum of six (6) valve charts with valve numbers indicating valve type, size, manufacturer and service.

D. Additional valve charts shall be mounted behind glazed wooden frames and be hung in each mechanical equipment room including each air handling unit mechanical equipment room. Additional copies shall be provided in each copy of the O&M manuals.

END OF SECTION

SECTION 23 05 48

VIBRATION CONTROLS FOR HVAC, PLUMBING AND FIRE PROTECTION EQUIPMENT

PART 1 RELATED DOCUMENTS

1.01 GENERAL

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 0I Specification Sections apply to work of this section.

B. All work under this section shall also be subject to the requirements of Division 23 Section, *Common Work Results for HVAC*.

1.02 SUMMARY

A. Provide all labor and materials necessary to furnish and install vibration control systems on this project as herein specified and/or shown on the drawings.

B. Mount all mechanical equipment on suitable vibration isolators so as to prevent transmission of vibration into or through the building structure. Isolators shall be as manufactured by Mason Industries, Inc., Korfund, Inc., Amber Booth, or approved equal, and shall be selected by the isolator manufacturer for each item of equipment in accordance with requirements hereinafter specified.

C. The equipment manufacturer shall supply all pump and motor bases, fan and motor bases, cradles, isolation pipe/duct hangers, spring and/or neoprene isolators, neoprene pads, flexible connectors, etc. as a coordinated package by a single manufacturer.

D. Select isolators for uniform static deflections according to distribution of weight; and for not less than the indicated isolation efficiency with the lowest rotational speed of equipment as the disturbing frequency.

E. Isolators and bases shall be stable during stopping and starting of equipment without transverse or eccentric movement of equipment, and shall be designed to resist horizontal forces of equipment which may operate unbalanced.

F. In general, select isolators on the basis of criteria as specified in the ASHRAE Applications Handbook, Latest Edition.

1.03 SUBMITTALS

A. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.

B. Product Data: Provide schedule of vibration isolator type with location and load on each.

C. Manufacturer’s Installation Instructions: Indicate special procedures and setting dimensions.

D. Manufacturer’s Certificate: Certify that isolators are properly installed and adjusted to meet or

exceed specified requirements.

E. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.04 PROJECT RECORD DOCUMENTS

A. Record actual locations of hangers including attachment points.

1.05 COLOR CODING

A. All springs shall be color coded for load carrying capacity.

1.06 ALTERNATES

A. Refer to Division 01 Section, *Alternates* - Alternates for description of work under this section affected by alternates.

1.07 LEED REQUIREMENTS

A. Refer to Division 01 Section LEED Requirements for description of work under this Division affected by LEED requirements.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Isolators shall be the equivalent of the following types by Mason Industries, Inc., Korfund, Inc. or approved equal.

2.02 CORROSION PROTECTION FOR STEEL PARTS

A. Where steel parts are exposed to weather or humid environments provide hot-dipped galvanized coating of at least 2 ounces of zinc per square foot of surface. Coat springs with neoprene.

2.03 SPRING MOUNTS AND SOUND PADS

A. Provide all spring mounts with leveling devices, minimum .25 inch thick neoprene sound pads, and zinc chromate plated hardware.

B. All sound pads shall be size for minimum deflection of .05 inch; meet requirements for neoprene

pad isolators.

2.04 SPRINGS

A. All springs shall have minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between .3 and .6 of maximum deflection.

2.05 NEOPRENE

A. Grade durometer 40, 50 OR 60 AND OIL RESISTANT.

2.06 SPRING ISOLATORS

A. General: Provide spring isolators or protected spring isolators that are adjustable and laterally stable with free-standing springs of horizontal stiffness at minimum 80 percent of the vertical (axial) stiffness. For machine-attached and floor-attached restraining elements, separate from metal-to-metal contact by neoprene cushions 1/8 inch thick minimum. Provide neoprene acoustic friction pads at least ¼ inch thick.

B. Spring Isolator: Spring type isolators shall be free standing and laterally stable without any housing and complete with ¼ " neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflections, compressed spring height and solid spring height. Mountings shall be type SLF as manufactured by Mason Industries, Inc. or as approved equal.

2.07 SUSPENSION ISOLATORS

A. General: Provide hangers with suspension isolators encased in open steel brackets. Isolate hanger rods from isolator steel brackets with neoprene-lined opening.

B. Suspension Neoprene Isolators: Provide double-deflection elements with minimum 3/8 inch deflection.

C. Suspension Spring Isolators: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30° arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include a scale drawing of the hanger showing the 30° capability. Hangers shall be type 30N.

2.08 NEOPRENE PAD ISOLATORS

A. Rubber or neoprene waffle pads.

1. 30 durometer
2. Minimum 2 inch (13mm) thick
3. Maximum loading 40 psi (275 kPa)

4. Height of ribs shall not exceed 0.7 times width.

B. Configuration: ½ inch (13mm) thick waffle pads bonded each side of ¼ inch (6 mm) thick steel plate.

2.09 RUBBER MOUNTS

A. Molded rubber designed for 0.6 inches (13 mm) deflection with threaded insert.

PART 3 EXECUTION

3.01 GENERAL PROVISIONS

A. Install vibration-and-noise isolation materials and equipment as indicated and in accordance with machinery manufacturer's instructions.

B. All vibration isolators exposed to weather or humid environment shall be hot dipped galvanized with springs coated with neoprene in accordance with paragraph hereinbefore described.

C. Anchor Bolts and Grout: Secure machinery to foundations and inertia bases with anchor bolts. Grout equipment with baseplates, the full area under baseplates with premixed non-shrinking grout. After grout has set, remove wedges, shims, and jack bolts and fill spaces with grout.

D. Common Machinery Foundations: Mount electrical motors on the same foundations as driven machinery. Support piping connections, strainers, valves, and risers on the same foundation as the pumps.

E. Lateral Motion: The installed vibration isolation systems for each piece of floor or ceiling mounted machinery shall have a maximum lateral motion under machinery start up and shut down conditions of not more than ¼ -inch. Restrain motions in excess by approved spring mountings.

F. Unbalanced Machinery: Provide foundation suspension systems specifically designed to resist horizontal forces for machinery with large unbalanced horizontal forces. Vibration isolator systems shall conform to the machinery manufacturer's recommendations.

G. Nonrotating Machinery: Mount nonrotating machinery in systems which includes rotating or vibrating machinery on isolators having the same deflection as the hangers and supports for the pipe connected to.

H. Unitized Machinery Assemblies: Unitized assemblies such as condensers, may be mounted on steel rails and springs in lieu of steel bases and springs. Where the slab or deck is less than 4 inches thick, provide spring isolation units with the deflection double that of the vibration isolation schedule, up to a maximum static deflection of 5 inches.

I. Vibration isolation ceiling hangers shall be installed so that the hanger rods do not touch the sides of the isolator housing, thereby seriously degrading the vibration isolation performance. Vibration isolation ceiling hangers shall be located so that the hanger housing may rotate 360° without touching any object.

J. Electrical Connections: Provide flexible conduit or multiple conductor cable connections for machinery with sufficient extra length to permit 2 inch minimum displacement in any direction without damage.

K. Systems Not To Be Vibration Isolated: Do not provide vibration isolation for electrical raceways and conduits or for fire protection, storm, sanitary, and domestic water piping systems which do not include pumps or other vibrating, rotating, or pulsating equipment including control and pressure reducing valves.

L. Install in accordance with manufacturer's instructions.

M. Install isolation for motor driven equipment.

N. Bases:

1. Adjust equipment level.

O. Install spring hangers without binding.

P. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

Q. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

R. Connect wiring to isolated equipment with flexible hanging loop.

3.02 ISOLATION FOR SPECIFIC EQUIPMENT

A. The vibration isolator manufacture shall provide isolators for all pieces of equipment provided for the job. Isolator shall be selected by the isolator manufacturer on the basis of criteria as specified in the ASHRAE Applications Handbook, latest edition, unless a more stringent requirement is indicated on the drawings.

B. Fans:

1. Fans up to 22" wheel diameter shall be mounted stable steel springs in series with ribbed neoprene pads selected for not less than 1.5" static deflection (Mason Industries Type SLF or equivalent).

2. Fans with wheel diameters 24" and greater shall be mounted on unhoused stable steel springs in series with ribbed neoprene pads and structural rails selected for not less than 2.5" static deflection (Mason Industries Type SLF or equivalent and structural rails Type ICS with thrust restraint provisions) and rails shall be Type ICS.

3. All fans suspended from the ceiling, joists or roof structure, including exhaust fans, shall be suspended using hangers incorporating steel springs in series with neoprene, selected for not less than 1" static deflection under full load (Mason Industries Type 30N or equivalent).

C. Heat Pump and VRV Outdoor Units**:** All heat pump units shall be supported on stable steel springs in series with ribbed neoprene pads and structural rails selected for not less than 2.5" deflection under full operating load. All exterior isolators for heat pump units shall be hot dipped galvanized including all hardware. Mason Industries Type SLF springs or as approved equal. Provide neoprene coated springs.

D. All unit heaters shall be suspended using hangers incorporating steel springs in series with neoprene selected for not less than 1" static deflection under full load (Mason Industries Type 30N or equivalent).

E. Ductless Units: Indoor ductless units shall be supported with rubber grommet type suspension isolators. Outdoor ductless units ductless units shall be supported on ribbed neoprene pads resting on roof curbs (roof application).

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC AND PLUMBING

PART 1. GENERAL

1.01. GENERAL

A. This section covers performance testing, adjusting and balancing of heating, ventilating, air conditioning and domestic re-circulating systems as specified in Division 23 Section, *Heating, Ventilating, and Air Conditioning Equipment* and in Division 22 Section, *Plumbing Fixtures and Plumbing Equipment.*

B. For *Common Work Results of HVAC,* See Division 23. See Division 01 for *General Requirements*.

C. The mechanical contractor shall select and employ an impartial, independent balancing agency to provide testing and balancing services for the heating, ventilating and air conditioning (HVAC) systems and other specified systems of this project.

D. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC and plumbing systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results.

E. The items requiring testing, adjusting, and balancing include, but are not limited to, the following:

<u>Air Systems</u>:
Coils (Air Temperatures & Static Pressure Drops)
Diffusers, Registers and Grilles
Ductless Split System Units (Indoors and Outdoor units)
Energy Recovery Ventilators
Electric Unit Heaters
Exhaust Fans
Hot Gas Re-heat Coils
Heat Pumps
Remote Heat Pump Units
Variable Refrigerant Volume Systems
Ventilation Fans
Zone Branch and Main Ducts

<u>Hydronic Systems</u>:
Domestic Hot Water Heater Pumps
Domestic Re-circulating Systems and Water Heater Pumps
Thermostatic Mixing Valves

1.02. RELATED DOCUMENTS

A. This project is to be LEED certified. Refer to Division 01 Section, including "Sustainable Design Requirements", "Construction Waste Managements", and "Commissioning Requirements" for mandatory work which may apply to all contractors, installers, and suppliers.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR 4.2): For products having recycled content, required documentations for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and Credit MR 5.2): For product manufactured, assembled or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.03. EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.

5. Duct systems are clean of debris.

6. Fans are rotating correctly.

7. Air coil fins are cleaned and combed.

8. Access doors are closed and duct end caps are in place.

9. Air outlets are installed and connected.

10. Duct system leakage is minimized.

11. Pumps are rotating correctly.

12. Proper strainer baskets are clean and in place.

13. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of

services which prevent system balance.

C. Beginning of work means acceptance of exiting conditions.

1.04. QUALIFICATIONS OF THE BALANCE AGENCY

A. The balancing agency shall be a member of the Associated Air Balance Council (AABC) and have an engineer certified by the National Examining Board.

B. The certified test and balance engineer shall be responsible for supervision and certification for the total work herein specified.

C. All final reports shall be signed and officially stamped by the certified test and balance engineer.

1.05. PRE-BALANCING CONFERENCE

A. Convene a conference one week prior to commencing work of this Section with all appropriate individuals.

1.06. STANDARDS

A. The balancing agency shall perform the services specified herein in accordance with the Associated Air Balance Council's National Standards, including revisions, to the date of the contract.

B. All terms in this specification shall have their meaning defined as stated in the National Standards.

C. ADC: Test Code for grills, registers, and diffusers.

D. ASHRAE III: Practice for measurement, testing, adjusting and balancing of building heating, ventilation, air conditioning, and refrigeration systems.

E. NEBB: Procedure standards for testing, adjusting, and balancing of environmental systems.

F. SMACNA: HVAC systems testing, adjusting, and balancing.

G. AABC: Associated Air Balance Council

1.07. COORDINATION

A. It will be necessary for the balancing agency to perform its services in close coordination with the mechanical contractor.

B. The plans and specifications have indicated meters, valves, dampers, and other devices for the purpose of adjusting the system to obtain optimum operating conditions. It will be the responsibility of the mechanical contractor to install these devices in a manner that will leave them accessible and readily adjustable. The balancing agency shall provide guidance if there is a questionable arrangement of a control or balancing device.

C. The general contractor, mechanical contractor, temperature control contractor and suppliers of the HVAC equipment shall all cooperate with the balancing agency to provide all necessary data on the design and proper application of the system components.

D. For heat pumps, the manufacturer's start-up agency and Test and Balance Engineer shall assist each other with obtaining proper flow rates and refrigerant pressures.

1.08. INSTALLATION TOLERANCE

A. Unless otherwise indicated, all air devices shall be adjusted to within plus or minus 10 percent of design. All fans shall be adjusted to within plus or minus 5 percent of design. All pumps and Hydronic equipment shall be adjusted to within plus or minus 5 percent of design.

1.09. RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR

A. The mechanical contractor shall sufficiently complete the installation and start all HVAC systems to insure they are working properly and shall perform all other items as described hereinafter to assist the balancing agency in performing the testing and balancing of the HVAC system.

B. Record equipment manufacturer's standard start-up information and submit to Engineer for review. Testing and balancing work shall not commence on any equipment until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.

C. Air Distribution Systems

1. Verify installation for conformity to design.

2. Terminate all supply, return, outside air, exhaust air, ventilation air ducts, and pressure test them for leakage. Test pressure and leakage rate shall be as specified in Division 23 Section, *HVAC Air Distribution System* under Leakage Tests. Pressure testing shall be performed by mechanical contractor and witnessed by Test and Balance Engineer.

3. Ensure that all volume dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside - return - relief, and exhaust air shall provide tight closure and full opening, with a smooth and free operation.

4. Verify that all supply - return - exhaust and transfer grilles; registers, and diffusers are installed and operational.

5. Ensure that air-handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.

6. Ensure that all fans are operating and free of vibration. All fans and drives shall

be checked for proper fan rotation and belt tension. Overload protection shall be of proper size and rating. A record of motor current and voltage shall be made to verify that the motors do not exceed nameplate rating. Record thermal overload ratings for all motors in the Test and Balance Report.

7. Make any necessary changes to the sheaves, belts, and dampers, as required by the balancing agency, at no additional cost to the owner.

8. Install clean filters.

9. For heat pumps, provide refrigerant suction and discharge pressure to Test and Balance Engineer for inclusion in the final TAB Report.

D. Water Circulating Systems

1. Verify installation for conformity to design.

2. Check all pumps to verify pump alignment and rotation.

3. Ensure that systems are clean, with the proper strainer screens installed for normal operation.

4. Check all pump motors for current and voltage, to ensure that motors do not exceed nameplate rating.

5. Provide thermal overload protection of proper size and rating. Record thermal overload ratings for all motors. Insert data in Test and Balance Report.

6. Ensure that all water circulating systems shall be full and free of air; that expansion tanks are set for proper water level; and that all air vents were installed at high points of systems and are operating.

1.10. RESPONSIBILITIES OF THE TEMPERATURE CONTROL CONTRACTOR

A. The temperature control contractor shall complete the installation of the temperature control system, and operate and test all control systems to ensure they are functioning properly as designed. The temperature control contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, freeze stats and duct smoke detectors.

2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3. Calibrate temperature sensors after installation, and before the temperature sensors control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditional space for each separately controlled zone.

4. The temperature control contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.

B. All control sequences, software, equipment, and components shall be started-up by a qualified technician. Start-up report shall be submitted to Engineer prior to the commencement of testing and balancing work. Testing and balancing shall not commence until start-up reports are completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

1.11. NOTIFICATION FOR TESTING AND BALANCING WORK TO BEGIN

A. The mechanical contractor shall notify the balancing agency in writing when all heating, ventilating, and air conditioning systems are complete and ready for testing and balancing. The mechanical contractor shall attest that he has completed all items as herein described.

B. The following must be completed prior to start of system balancing:

1. All duct work and associated grilles/registers/diffusers installed and completed.

2. Piping systems completed, flushed and filled.

3. Equipment properly started by qualified personnel or start-up technicians.

4. Ceiling tiles installed.

5. Automation system (temperature controls) installed and completed for both air and water systems.

6. All equipment controlled in automatic (“Auto”) mode.

7. Access granted to the balancing contractor to the automation/controls system provided.

1.12. DEFICIENCIES

A. Any deficiencies in the installation or performance of a system or component observed by the TAB agency shall be brought to the attention of the appropriate responsible person.

B. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected Contractor before the TAB Agency returns to retest. Unresolved deficiencies shall be noted in the final report.

1.13. ADJUSTING

A. Ensure recorded data represents actual measured observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring all sensors to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

F. Check and adjust systems approximately six months after final acceptance and submit report.

G. Permanently mark the locations of all duct traverses on the outside duct insulation.

1.14. ALTERNATES

A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

1.15. LEED REQUIREMENTS

A. Refer to Division 01 Section LEED Requirements for description of work under this Division affected by LEED requirements.

B. Submit air balance report for LEED Prerequisite IEQ1: Documentation of work performed for ASHRAE 62.1 Section 7.22- “Air Balancing”.

C. Submit report for LEED Prerequisite EA2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 “System Balancing”.

1.16. GENERAL COMMISSIONING REQUIREMENTS

A. Refer to Division 01 Section, “General Commissioning” for description of work under this Division affected by General Commissioning.

B. Submit air balance report for LEED Prerequisite IEQ1: Documentation of work performed for ASHRAE 62.1 Section 7.22, “Air Balancing”.

C. Submit report for LEED Prerequisite EA2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 “System Balancing”.

PART 2. PRODUCTS (NOT APPLICABLE)

PART 3. EXECUTION

3.01. GENERAL

A. Perform all testing and balancing in complete accordance with AABC National Standards for Field Measurements and Instrumentation.

B. Furnish all test instruments and equipment. All instruments must have been calibrated within six (6) months prior to use and shall be checked for accuracy prior to and during the work.

C. Review all systems designs and equipment, manufacturers' data, and be completely familiar with the work before proceeding.

D. Report all malfunctions or deficiencies to the contractor so that corrective action can be taken. Test and Balance Report shall not be submitted for review until all malfunctions or deficiencies are corrected. Repeat tests where required until design conditions are achieved.

E. Where systems or equipment cannot be balanced or adjusted to design conditions, determine the cause and submit a complete report to the Engineer.

F. Retest or rebalance the system as required during the warranty period.

G. Test and balance all systems under adequate load condition. If, in the opinion of the Engineer, there is insufficient load to properly test and balance the systems, perform sufficient preliminary balancing and adjustment to permit operation of the systems until such time as final testing and balancing can be done. Provide in writing the future date when systems shall be tested under sufficient load.

H. At project completion provide a complete set of ½ scale drawings indicating the locations of all duct traverses.

3.02. EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems – Duct Design". Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens and indicated perforations.

L. Examine system pumps to ensure absence of entrained air in the suction piping.

M. Examine operating safety interlocks and controls on HVAC equipment.

N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.03. AIR SYSTEM PROCEDURES

A. The balancing agency shall perform the following testing and balancing functions in accordance with the Associated Air Balance Council's National Standards:

1. Fan Speeds - Test and adjust fan RPM to achieve design CFM requirements.

2. Current and Voltage - Measure and record motor current and voltage. Check and record thermal overload ratings for all motors.

3. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main supply, return and exhaust ducts to obtain total CFM. If a Pitot-tube traverse is not practical, the summation of the outlets or inlets may be used. An explanation why a traverse was not made must appear on the appropriate data sheet.

4. Outside Air - Test and adjust system minimum outside air by Pitot-tube traverse. If a Pitot-tube traverse is not practical, the percentage of outside air may be determined by calculations from the return air, outside air, and mixed air temperatures. Make allowances for heat of compression and motor heat where

applicable.

5. Static Pressure - Test and record system static pressures, including suction and discharge static pressure of each fan. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make fan RPM allowances for 50 percent loading of filters.

6. Air Temperature - Take wet-bulb and dry-bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

7. Zone Ducts - Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.

8. Main Ducts - Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.

9. Branch Ducts - Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.

10. Tolerances - Test and balance each diffuser, grille, and register to within 10 percent of design requirements. Test and balance all fans to within 5 percent of design requirements.

11. Identification - Identify the location and area of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

12. Description - Record the size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.

13. Minimizing Drafts - Adjust all diffusers, grilles, and registers to minimize drafts in all areas.

14. Test and Balance Engineer shall witness and record all leakage testing of ductwork. Leakage test data shall be included in final Test and Balance Reports.

15. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable air volume systems at maximum air flow rate, full cooling, and at minimum airflow rate, full heating.

16. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

17. For heat pumps, assist start-up organization or manufacturer's representative with start-up. Record air flow rates, water flow rates and electrical characteristics prior to refrigerant pressure measurement and settings.

18. For all equipment specified with condensate overflow safety switches/floats test operation of such device and record results. Verify interlock with ATC system.

3.04. WATER SYSTEM PROCEDURES

A. The various water circulating systems shall be filled, purged of air, and put into operation before hydronic balancing by the mechanical contractor.

B. The balancing agency shall perform the following testing and balancing functions in accordance with the AABC National Standards.

C. All domestic re-circulating pumps shall be Tested and Balanced as described below:

1. Strainers - Request that the mechanical contractor clean all strainers.

2. Air Vents - Check all air vents at the high points of the water system and determine if they are installed and operating.

3. Valves - Set all balancing valves to the full-open position for balancing.

4. Pumps - Adjust all pumps and domestic hot water re-circulating water pumps to meet design GPM requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Measure and record operating current and voltage. Check and record thermal overloads installed on all pumps. Record in Test and Balance Report.

5. Tolerances - Proceed to balance all pumps, balance valves to within 5 percent of design requirements.

6. Marking - Mark all settings and record all data after completing the flow readings and coil adjustments.

3.05. DOMESTIC HOT WATER RE-CIRCULATING SYSTEMS PROCEDURES

A. The domestic hot water re-circulating system shall be tested and balanced as indicated on the contract documents including:

1. Balance of circuit setters to design quantities indicated on contract documents.

2. Balance of re-circulating pumps to meet design GPM requirements.

B. Domestic Water Heaters/Generators:

1. Verify that all domestic water heaters have been filled and started by others and are in operation.

2. Test and record outlet temperature of water heater at approximate design recovery.

3. Current and Voltage: As applicable, test and record voltage and amperage, compare data with nameplate limits to ensure water heater elements or burners do not exceed nameplate data.

4. Test discharge temperature and flow rate at all lavatory/hand sink mixing valves.

Also measure time period for fixtures to obtain hot water.

3.06. LIFE SAFETY CONTROLS TESTING PROCEDURES

A. The TAB agency shall test and record life safety control operation on the HVAC equipment. It shall verify the installation of required smoke detectors in air handling equipment (AHE), and shall verify operation of the smoke detector by activating the smoke detector and observing air handler shutdown. With the controls and alarm contractors, the TAB agency shall verify the operation of interconnected systems such as the AHU smoke detector's activation of the fire alarm system and the alarm system's activation of the life safety control sequences. Record results of tests within TAB report.

3.07. VERIFICATION OF TEMPERATURE CONTROL

A. The balancing agency shall be assisted by the temperature control contractor in verifying the operation and calibration of all temperature control systems. The following tests shall be conducted:

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset.

2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3. Verify the accuracy of the final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

4. Test and calibrate all air flow monitoring stations for proper air flow.

3.08. TEST AND BALANCE REPORTS

A. The test and balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound. The report shall be certified accurate and complete by the balancing agency's certified test and balance engineer.

B. Six (6) copies of the test and balance report are required and shall be submitted to the Engineer. If, in the opinion of the Engineer, test results or portions thereof are incomplete or inconclusive, repeat necessary portions of the work to the satisfaction of the Engineer.

C. The report shall contain the following general data in a format selected by the balancing agency:

1. Project Number

2. Contract Number

3. Project Title

4. Project Location

5. Project Architect

6. Project Mechanical Engineer

7. Test & Balance Agency

8. Test & Balance Engineer

9. Construction Manager

10. Mechanical Subcontractor

11. Dates tests were performed

12. Certification

13. Duct Leakage Tests

14. Phone Numbers of all Individuals Listed Above

D. The test and balance report shall be recorded on report forms conforming to the recommended forms in the AABC National Standards.

3.09. TEST REPORT FORMS

A. Air Moving Equipment and Fan Test Forms - Submit fan curve showing design and operating points of operation. Also, record the following on each air-handling equipment test form:

1. Manufacturer, model number, serial number, arrangement.

2. All design and manufacturer-rated data.

3. Total actual CFM by traverse if practical. If not practical, the sum of the outlets may be used, or a combination of each of these procedures. For specific systems, such as ones with diversity, see the AABC National Standards.

4. Suction and discharge static pressure of each fan, as applicable. Include pressure drops across coils, filters, and similar devices.

5. Outside-air, return-air, and exhaust air total CFM.

6. Actual operating current, voltage and brake horsepower of each fan motor. For packaged equipment, this includes supply fans, relief air fans, and condenser fans.

7. Final RPM of each fan.

8. Fan and motor sheave manufacturer, model, size, number of grooves, bore, and center distance.

9. Belt size, quantity and make.

10. Static-pressure controls final operating set points (if applicable).

11. Total and external static pressure.

B. Heating and Cooling-Coil Test Forms - Record the following items on each test form:

1. Manufacturer, location, service.

2. All design and manufacturer's rated data.

3. Rated and actual static pressure drop across each coil.

4. Wet-bulb and dry-bulb temperatures entering and leaving each cooling coil; dry-bulb temperatures entering and leaving each heating coil.

5. Air flow (Design and Actual).

6. For DX-coil, provide design and actual saturated suction temperature.

7. For DX-Coil, provide suction and discharge pressures.

C. V-Belt Drive Test Forms:

1. Identification/location.

2. Required driven RPM.

3. Driven sheave, diameter and RPM.

4. Belt, size and quantity.

5. Motor sheave diameter and RPM.

6. Center to center distance, maximum, minimum, and actual.

D. Duct Traverse Test Forms:

1. System zone/branch.

2. Duct size.

3. Area.

4. Design velocity.

5. Design air flow.

6. Test velocity.

7. Test airflow.

8. Duct static pressure.

9. Air temperature.

10. Air correction factor.

E. Duct Leakage Test Forms:

1. Description of ductwork under test.

2. Duct design operating pressure.

3. Duct design test static pressure.

4. Duct capacity, air flow.

5. Maximum allowable leakage duct capacity times leak factor.

6. Test apparatus.

a). Blower.

b). Orifice, tube size.

c). Orifice size.

d). Calibrated.

7. Test static pressure.

8. Test orifice differential pressure.

9. Leakage.

F. Air Distribution Test Sheet:

1. Air terminal number.

2. Room number/location.

3. Terminal type.

4. Terminal size.

5. Area factor.

6. Design velocity.

7. Design air flow.

8. Test (final) velocity.

9. Test (final) air flow.

10. Percent of design air flow.

G. Ductless Unit Test Forms:

1. Manufacturer

2. Type, air conditioning, heat pump

3. Identification number

4. Location

5. All design and manufacturer's rated data.

6. Rated and actual entering and leaving dry bulb temperatures.

7. Rated and actual entering and leaving wet bulb temperatures.

8. Air flow (design and actual)

9. Provide actual saturated suction temperature.

10. Actual operating current, voltage and brake horsepower of each fan motor.

11. Final fan RPM.

12. For Air Cooled Variable Refrigerant Volume System test current, voltage, RPM, and breaker horsepower for outdoor unit.

H. Energy Recovery Ventilators Test Forms: Submit fan curve showing design and operating points of operation. Also, record the following on each air-handling equipment test form:

1. Manufacturer, model number, serial number, arrangement.

2. All design and manufacturer-rated data.

3. Total actual CFM by traverse if practical. If not practical, the sum of the outlets may be used, or a combination of each of these procedures. For specific systems, such as ones with diversity, see the AABC National Standards.

4. Suction and discharge static pressure of each fan, as applicable. Include pressure drops across coils, filters, energy wheels, and similar devices.

5. Outside-air, and exhaust air total CFM.

6. Actual operating current, voltage and brake horsepower of each fan motor.

7. Final RPM of each fan.

8. Fan and motor sheave manufacturer, model, size, number of grooves, bore, and center distance.

9. Belt size, quantity and make.

10. Total and external static pressure.

11. Rated and actual static pressure drop across each energy wheel.

12. Wet-bulb and dry-bulb temperatures entering and leaving each cooling coil, heat pipe and energy wheel. Dry-bulb temperatures entering and leaving each heating coil.

13. For DX-coil, provide design and actual saturated suction temperature.

14. Record carbon dioxide set points and actual readings for exhaust air stream at each ERV and global CO_2 sensor.

15. Entering and leaving air temperatures at hot gas re-heat coils.

I. Air Cooled Heat Pump Unit Test Forms:

1. Manufacturer

2. Model Number

3. Location

4. Size/Capacity

5. Fan RPM (Min and Max)

6. Compressor and Heat Pump Fan Electrical Characteristics

7. Condenser Fan RPM

8. Amp Draw of all Components

9. Refrigerant Suction/Discharge Pressures

10. Thermal Overload Sizes

J. Thermostatic Mixing Valve Test Forms

1. Manufacturer, Model Number, Series, Arrangement
2. All manufacturer data.
3. Verify all strainers are clean.
4. Leaving temperature actual and design.

K. Water Heater Test Forms

1. Manufacturer, Model Number, Series
2. All manufacturers' data.
3. Verify all safeties.
4. Record leaving water temperature actual and design.
5. Record electrical characteristics

L. Condensate Over Flow Switches/Floats

1. Manufacturer
2. Type
3. Location
4. Equipment shut down verification
5. ATC interlock verification

END OF SECTION

SECTION 23 06 00

HEATING, VENTILATING, AND AIR CONDITIONING EQUIPMENT

PART 1 GENERAL

1.01 GENERAL

A. The Conditions of the Contract and other General Requirements apply to the work specified in this section. All work under this section shall also be subject to the requirements of Division 23 Section, *Common Work Results for HVAC* and Division 01 Section *General Requirements.*

1.02 DESCRIPTION

A. The work to be performed shall include all labor, materials and equipment necessary to furnish and install complete, all mechanical equipment as shown on drawings, hereinafter specified or reasonably implied, and leaving the same in satisfactory operation condition. It is the intent that systems be installed complete with all items necessary to accomplish this purpose.

1.03 SUBMITTALS

A. Shop Drawings: Indicate assembly, equipment dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

B. Product Data:

1. Provide literature which indicates dimensions, weights, capacities, ratings, performance, gages and finishes of materials, and electrical characteristics and connection requirements.
2. Provide data of filter media, filter performance data, filter assembly, and filters frames.
3. Provide fan curves with specified operating point clearly plotted.
4. Submit sound power level data for both fan outlet and casing radiation at rated capacity. Submit sound power levels by octave band or sound pressure levels by octave band for all equipment.
5. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.04 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of General Requirements.

B. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

C. Store all equipment in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

D. Comply with manufacturer's installation instructions for rigging, unloading and transporting equipment.

E. Protect all motors, shafts, and bearings from weather and construction dust.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not operate any equipment for any purpose, temporary or permanent, until ductwork/piping is clean, filters/strainers are in place, bearings lubricated, and equipment has been test run under observation.

1.07 ALTERNATES

A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

1.08 LEED REQUIREMENTS

A. Refer to Division 01 Section, "LEED Requirements" for description of work under this Division affected by LEED requirements.

PART 2 PRODUCTS

2.01 RECESSED ELECTRIC CABINET UNIT HEATER

A. Unit heaters shall be blow-through design with motor and fans in the air stream below electric heating bank. Fan discharge shall be baffled to insure even air flow through entire area of heating bank for even outlet temperatures. All models shall be floor or ceiling mounted as scheduled. Leveling bolts and bottom inlets shall be provided. Units shall be Type CU as manufactured by Chromalox, Marcor, Emerson, Trane, Markel, Indeeco, or approved equal.

B. All solid panels of the front, top, and bottom panels shall be internally insulated to provide quiet operation and low surface temperatures. Complete unit assembly shall be listed and approved by Underwriter's Laboratory, Inc.

C. Base color shall be selected by the Architect. Casing shall be given a 5- stage phosphatizing treatment prior to application of high gloss baked enamel finish. Casing top and front shall be 16 gauge with 18 gauge front accent panel. Discharge grille shall be a continuous stamped louver. Front access panel fasteners shall be Phillips head.

D. For safety, the electric heating bank shall consist of metal sheath heating elements. The elements shall have a copper clad steel sheath for strength and corrosion resistance, and aluminum fins for faster heat transfer.

E. Fin tubes shall be installed or removed individually, and shall be center anchored to insure noiseless expansion and contraction.

F. Automatic reset snap-action type thermal protection shall be furnished through holding coil circuit of the control system relay(s) for protection in the event of overheating due to air blockage from any cause. Thermal protector shall be linear type to sense temperatures the entire length of heating elements, to detect localized overheating from partial air blockages.

G. Motor and fan assembly shall be direct drive on all unit sizes, using extended motor shaft on one fan unit, double extended motor shafts on two fan unit and coupling with hollow steel shafts and end bearing on three, four and five fan units. Two-speed permanent split capacitor type motors with built-in automatic reset motor overload protection shall be standard.

H. Fan shall be forwardly curved double inlet centrifugal type, aluminum construction - and shall be modular in design.

I. Motor and fans shall be mounted on an extra heavy 14 gauge galvanized mounting plate, forming an easily removable assembly. Motor leads shall be plug-in type for easy removal of the motor and fan assembly. Combination two-step, two-heat tamperproof switch shall be located with access through discharge air grille, using Allen key for adjustment.

J. A permanent reusable polyurethane type filter shall be provided. All models shall have filter access through removable front access panel.

K. All recessed units shall have wall-guard or ceiling type recess flanges which protect the wall/ceiling from direct contact and damage when access panels are removed or replaced for normal maintenance. Units are to be fully recessed.

L. Furnish and install aATC system compatible temperature sensor with temperature adjustment range between 50 degrees F and 80 degrees F. Furnish control transformer wiring, thermostat guard programming and all other control components as required.

M. An integral fan delay switch shall be standard, to prevent discharge of cold air, by delaying start-up of the fan motor until heating elements have warmed up. This same fan delay switch shall maintain motor operation after heating elements have been de-energized to dissipate any residual heat.

N. Units shall be equipped as standard with a two speed/two heat selector switch which permits simultaneous tamper-resistant "high-low" adjustment of fan speed and heat output by means of an Allen key though discharge grille.

O. A summer fan switch shall be provided to energize fans only for summertime operation.

P. Units shall have a built-in circuit breaker as a positive disconnecting means per the National Electrical Code.

2.02 FANS

A. General

1. Provide fans as indicated on the drawings. All fans shall have been tested and their performance rated in accordance with Air Movement and Control Association, Inc., Bulletin 210-85 Test Code and shall be licensed to bear the AMCA Seal. All fans shall carry the AMCA Certified Rating Seal for air and sound. Sound power levels shall be submitted for approval. Fan curves shall be submitted with all fan shop drawings.

2. Fan manufacturer shall submit under what duct configuration (unducted, partially ducted, or ducted) the manufacturer certified the performance of a particular fan or group of fans.

3. When indicated on Contract Drawings provide inverter duty rated motors for all variable speed fans.

B. In-Line Fans

1. Direct Drive

a. Furnish and install in-line centrifugal direct drive fans of the size, capacity, and electrical characteristics as shown on the contract drawings.

b. Duct mounted in-line shall be of the centrifugal, direct driven in-line type.

The fan housing shall be of the square design, constructed of heavy gauge galvanized steel and shall include square duct mounting collars.

c. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components. All in-line fans shall be factory insulated. The housing interior shall be insulated with 2-inch acoustical insulation.

d. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

e. Motors shall be permanently lubricated and carefully matched to the fan loads. Motors shall be readily accessible for maintenance. Motors shall be high efficiency type.

f. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

g. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future

identification.

h. Fans shall be complete with backdraft damper, and unit mounted solid state speed controller.

i. Fans shall be Model SQ as manufactured by Greenheck, Acme Engineering, Penn Ventilator, Cook or approved equal.

2.03 ENERGY RECOVERY VENTILATOR

A. General

1. The unit(s) shall be installed in strict accordance with the specifications. Unit(s) shall be complete with all components and accessories as specified. All units shall be factory assembled, internally wired, and 100% run tested to check operation, fan and blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be numbered for simplified identification. Units shall be ETL listed and labeled, classified in accordance with ANSI-UL 1995/CAN/CSA C22.2 No. 236.

2. Units shall be manufactured by Aaon, Venmar, Greenheck, or approved equal.

3. Unit shall consist of packaged outdoor ERV/air handling unit with hot gas re-heat coil, heat pump coil, controls, filter housing, enthalpy wheel, variable frequency drives, inverter duty motors, and remote outdoor heat pump unit.

4. Furnish and install motor bearing protective rings at all variable frequency drive motors. Refer to Division 23 Section, “Common work Results for HVAC”.

B. Quality Assurance

1. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

2. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

3. Unit Energy Efficiency Ratio (EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

4. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label.

5. Unit and components shall be designed, manufactured, and independently analyzed, rated and certified to meet with the seismic compliance standards of the International Building Code, 2010 edition, Section 1621. If requested, unit

shall be provided with Certificate of Compliance indicating that the unit and components meet seismic design requirements.

C. Warranty

1. Manufacturer shall provide a total warranty for a period of 24 months from the date of substantial completion. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

D. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.

3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel. Exterior shall be primed and painted in color as selected by the Engineer.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Access to filters, dampers, cooling coils, reheat coil, exhaust fans, energy recovery wheels, compressors, condensers, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

6. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

7. Units shall include double sloped 304 stainless steel drain pans.

8. Unit shall include lifting lugs on the top of the unit.

9. Furnish and install all dampers and actuators. Outside air damper and exhaust air damper shall be enclosed in a factory furnished rainhood.

E. Electrical

1. Unit shall be provided with standard power block for connecting power to the unit.

2. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.

3. Air-source heat pump shall include an optimized start defrost cycle to prevent frost accumulation on the outdoor coil during heat pump heating operation and to minimized defrost cycle energy usage. If the temperature of the outdoor heat exchanger and/or the suction line is less than a predetermined value, a deferred defrost cycle is initiated wherein the defrost cycle starts after a variable, continuously optimizing, time interval has elapsed. The defrost cycle is terminated when the relative temperatures of the outdoor heat exchanger and/or the suction line indicate that sufficient frost is melted from the heat exchanger to insure adequate time between successive defrost cycles for optimizing the efficiency and reliability of the system, or after a predetermined time interval has elapsed, whichever condition occurs first. During defrost cycle all compressors shall energize, and reversing valves shall de-energize.

4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal.

5. Unit shall be provided with manual reset low temperature limit controls which shut off the unit when the discharge temperature reaches a field adjustable setpoint.

F. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

2. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.

3. Motors shall be inverter duty rated, premium efficiency, ODP with ball bearings rated for 200,000 hours service with external lubrication points.

4. Variable frequency drives shall be factory wired and mounted in the unit.

G. Exhaust Fans

1. Exhaust dampers shall be sized for 100% exhaust air flow rate.

2. Fans and motors shall be dynamically balanced.

3. Motors shall be inverter duty rated, premium efficiency, ODP with ball bearings rated for 200,000 hours service with external lubrication points.

4. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn handles.

5. Variable frequency drives shall be factory wired and mounted in the unit.

H. Evaporator Coil

1. Evaporator Coil

a. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

b. Coils shall have interlaced circuitry and shall be standard capacity.

c. Coils shall be helium leak tested.

d. Coils shall be furnished with a factory installed thermostatic expansion valves.

I. Refrigeration System

1. Unit shall be factory charged with R-410A refrigerant.

2. Compressors shall be scroll type with thermal overload protection, independently circuited, and carry a 5 year warranty. Heating and cooling shall be provided by an airside heat pump system.

3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam insulated panels to prevent the transmission of noise outside the cabinet.

4. Compressors shall be isolated from the base pan with the compressor manufacturer’s recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

5. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and factory installed liquid line filter driers.

7. Unit shall include modulating capacity control through digital scroll compressors.

8. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit(s) which shall be capable of modulation from 10-100% of its capacity.

9. Lead refrigeration circuit(s) shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

10. Unit shall be configured as an air-source heat pump. Each refrigeration circuit shall each be equipped with a factory installed liquid line filter drier with check valve, reversing valve, accumulator, and thermal expansion valves on both the indoor and outdoor coils. Reversing valve shall energize during the heat pump heating mode of operation.

11. Each refrigeration circuit shall include adjustable compressor lockouts.

J. Remote Heat Pump

1. Remote Air-Cooled Heat Pump Unit

a. Heat Pump fans shall be vertical discharge, axial flow, direct drive fans.

b. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.

c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

d. Coils shall be helium leak tested.

e. Heat pump fans shall be high efficiency electrically commutated motor (ECM) driven with factory installed head pressure control module. Heat pump airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable

compressor lockout.

K. Filters

1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 7, upstream of the cooling coil. Furnish a complete set of spare filters.

L. Demand Control Ventilation Components

1. Energy recovery ventilator fans shall be controlled by a variable frequency drive. Outdoor air and exhaust air fans shall be controlled simultaneously to maintain desired building pressure. Variable frequency drive shall be pre-programmed at the factory and shall assure that minimum outdoor air and exhaust air volumes are always maintained. The variable frequency drive shall be factory mounted in the unit cabinet and wired.

2. Energy recovery ventilator shall be equipped with demand control ventilation capabilities that enable the varying of outdoor air and exhaust air volumes based on building occupancy. A sensor shall be located in the exhaust air stream and in the locations shown on the drawings to monitor average CO2 levels of the occupied spaces. A variable frequency drive shall receive a 0-10 volt signal from the CO2 sensor and control the outdoor air volume to maintain a maximum of 1,000 ppm of CO2 in the occupied space. Outdoor air and exhaust air fans shall be controlled simultaneously to maintain desired building pressure. Variable frequency drive shall be pre-programmed at the factory and shall assure that minimum outdoor air and exhaust air volumes are always maintained. The exhaust sensor and variable frequency drive shall be factory mounted and wired. The space CO2 sensors shall be field installed and field wired.

3. Furnish each energy recovery ventilator with the following:

   a. Supply air fan variable frequency drive.
   b. Exhaust air fan variable frequency drive.
   c. Carbon Dioxide (CO2) Sensor.
   d. Furnish with additional outside air carbon dioxide (CO2) sensor to display ambient CO2 levels. (Interlock with ATC system.)
   e. Space humidity sensor for dehumidification.

M. Energy Recovery

1. Unit shall contain a factory mounted and tested energy recovery wheel(s). The energy recovery wheel(s) shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.

2. The energy recovery component shall incorporate a rotary wheel in an insulated

cassette frame complete with seals, drive motor and drive belt.

3. Wheels shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.

4. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.

5. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

6. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with *ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers* and *AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.*

7. Energy recovery wheel cassette shall carry a 5 year warranty.

8. Furnish spare energy recovery wheel belt.

9. Hinged service access door shall allow access to the wheel(s).

10. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

N. Controls

1. Factory Installed and Factory Provided Controller

a. Provide modular system manager for control of energy recovery ventilator at unit.

b. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.

c. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

d. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

e. Controller shall include non-volatile memory to retain all programmed values, without the use of an external battery, in the event of a power failure.

f. Modulating hot gas re-heat shall be supplied with a field installed supply air temperature sensor to control the amount of re-heating. Supply air temperature setpoint shall be field adjustable.

g. With enthalpy activated fully modulating economizer option, an outdoor air humidity sensor shall be factory installed.

h. With the modulating hot gas reheat option a space humidity sensor and supply air temperature sensor shall be furnished with the unit for field installation. Suction pressure sensor shall be factory installed. Supply air temperature and space humidity setpoints, for the dehumidification mode of operation, shall be adjustable.

i. Outside air temperature sensor shall be factory mounted and wired. Supply air temperature sensor shall be furnished with the unit for field installation.

j. Furnish controls with the necessary interfaces to communicate via BACNET/IP or LonWorks to a building automation system. Coordinate interface requirements with selected ATC subcontractor's system requirements.

k. All inputs and outputs on the manufacturer's controller shall be viewable via the interface.

l. All setpoints and schedules shall be editable via the interface by the Building Automation System.

m. In addition to standard inputs/outputs provide additional inputs/outputs as required to accomplish sequence of operation and items listed on point list.

n. The manufacturer shall be responsible for assisting and participating in the integration of the equipment into the Building Automation System and shall provide programming, testing, verification and on site personnel as required.

O. Unit Sequence of Operation

1. General

a. ERV supply fan and ERV exhaust fan shall be interlocked to operate simultaneously.

b. When the ERV is de-energized, the outside air damper, (D-1) and exhaust air damper (D-2) shall close. The heat pump unit shall de-energize whenever the ERV fans are de-energized.

c. All dampers shall be provided with end switches to prevent operation of ERV supply fan and ERV exhaust fan until dampers are proved open.

d. The energy recovery unit shall operate with packaged controls to stage compressors and modulate compressor speed to provide heating/cooling. ATC subcontractor shall coordinate with energy recovery unit manufacturer's controller to provide all requirements, interlocks, relays, etc.

e. Furnish and install all interlock wiring to remote heat pump unit.

f. Furnish supply air and exhaust air variable frequency drives and carbon dioxide sensors to allow air flow modulation based on carbon dioxide levels.

g. All set point temperatures shall be resettable and adjustable through software. All temperature sensors shall be monitored.

h. A global outside air carbon dioxide sensor shall allow re-set of $C0_2$ sensor set points based on outside air CO_2 levels.

i. Field install space humidity sensor for dehumidification and hot gas reheat control.

j. Provide differential static pressure sensors to determine filter loading of the ERV.

k. Field installed airflow monitoring station shall be provided for supply duct.

2. Occupied Cycle:

a. The energy recovery ventilator fans and energy recovery wheel shall operate continuously to provide tempered, 100 percent outside air to the spaces.

b. The unit shall be arranged for a winter time morning warm-up cycle and a summer time morning pull down cycle (from 8:00 a.m. to 9:00 a.m.).

c. Morning warm-up cycle: During morning warm-up cycle, the outside air damper, (D-1), shall open and exhaust air damper (D-2) shall open. The energy recovery wheel shall rotate continuously. The unit fan shall operate in morning warm-up mode until the discharge air temperature (T-1) rises to 70 degrees F (adjustable). At that point the heat pump shall operate under its packaged controls to provide heat in stages to maintain discharge air temperature at 72 degrees Fahrenheit.

d. Morning pull down cooling cycle: During morning pull down cooling cycle, the outside air damper (D-1) shall open and exhaust air damper (D-2) shall open. The energy recovery wheel shall rotate continuously. The packaged discharge air temperature controller (T-1) shall operate unit under packaged controls and energize the condensing unit to provide cooling in stages. The ERV shall remain in the morning pull down cycle until the discharge air sensed at T-1 drops to 78 degrees F (adjustable). The ERV shall then run continuously. Simultaneously, the condensing unit controller shall be placed under the control of the packaged discharge air temperature controller, (T-1). Upon completion of morning cool down period, the discharge air temperature controller, T-1, shall operate the unit cooling coil and hot gas re-heat coil to maintain space neutral (75 deg F, adjustable) discharge air conditions. A space humidity sensor shall override the discharge air temperature to provide dehumidification while providing hot gas re-heat.

e. Discharge air temperature (T-1) shall be resettable and adjustable through software.

f. Demand Controlled Ventilation: The main exhaust air stream prior to energy recovery wheel shall contain a CO2 sensor and select spaces will contain a CO2 sensor. CO2 sensors shall modulate the supply and exhaust air streams to maintain the CO2 level at 1,000ppm (adjustable). The minimum fan airflow rates shall be as scheduled. Set up and test minimum airflow rates with Test & Balance Engineer so that fans do not operate below minimum airflow rates regardless of measured CO2

levels. The CO_2 sensors shall modulate air flow rates in a linear fashion from minimum to maximum based on CO_2 measurements and re-set schedule. Coordinate with ATC Subcontractor. The CO2 sensor with the highest reading shall take priority control of fans using a discriminator control strategy.

3. Unoccupied Cycle:

a. During the unoccupied cycle the supply fan and exhaust air fans shall be de-energized. Outside air damper (D-1), exhaust damper (D-2), shall close and the refrigerant system shall de-energize when the supply fan is turned off.

Q. Roof Curb

1. An insulated, pre-fabricated roof curb shall be provided and shipped knocked down. The roof curb will be made of 16-gauge galvanized steel with 4" flanges, minimum 14" high with a factory installed 2" x 3" wood nailer strip. Curbs shall be fully insulated with 1 ½ inch thick rigid insulation with duct adapters.

2. Electrical shall enter unit concealed within roof curb. All piping within the unit enclosure shall be insulated with insulation type, thickness, and jacketing as specified in Division 23 Section, *HVAC Insulation*.

3. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least ½ inch in height around the opening.

2.04 AIR MONITORING STATIONS:

A. General: Provide complete air monitoring station for ERV unit as indicated on drawings.. The air monitoring station shall include airflow measuring stations, static pressure probes and electronic velocity pressure transmitter. All components shall be of the same manufacturer. The manufacturer shall be Air Monitor or as approved equal. An air monitor station shall be provided for each supply duct main and return duct main as indicated on contract drawings. All air flow monitoring stations shall be fully externally insulated to prevent condensation.

B. Air Monitor Airflow Measuring Stations

1. Provide where indicated, airflow measuring stations capable of continuously monitoring the fan or duct capacities (air volumes) they serve.

2. Each airflow measuring station shall contain multiple total and static pressure sensors positioned at the center of equal area of the station cross-section and interconnected by their respective averaging manifolds. For stations of 4 square feet or less, one total and one static pressure sensor shall be present for every 16

square inches of station area respectively. For stations of larger area, one total and one static pressure sensor shall be present for every 36 square inches of station area respectively.

3. The airflow measuring station shall be fabricated of a minimum of 14 ga. galvanized steel, welded casing in 8-inch depth with 90 degree connecting flanges in a configuration and size equal to that of the duct it is to be mounted into. Each station shall be complete with an open parallel cell air straightener or air equalizer honeycomb mechanically fastened to the casing, total and static pressure sensors located on an equal area basis and connected to symmetrical averaging manifolds, internal piping, and external pressure transmitter ports. An identification label shall be placed on each station casing listing model number, size, area, and specified airflow capacity.

4. Cell construction shall be 3/8-inch .003-inch, type 3003 aluminum, expanded.

5. The maximum allowable pressure loss through the station shall not exceed .015-inch wc at 1000 fpm, or .085-inch wc at 2000 fpm. Each station shall be capable of measuring the airflow rate within an accuracy of 2 percent as determined by U.S.G.S.A. certification tests. The stations shall have a self-generated sound rating of less than NC 40, and the sound level within the duct shall not be amplified, nor shall additional sound be generated.

6. Stations shall be Fan-E type as manufactured by Air Monitor Corporation, Paragon or as approved equal.

C. Air Monitor Duct Static Pressure Traverse Probes

1. Provide where indicated duct static traverse probe capable of continuously monitoring the duct or system static pressure it serves.

2. Each duct static traverse probe shall contain multiple static pressure sensors located along the exterior surface of the cylindrical probe. Said sensors shall not protrude beyond the surface of the probe.

3. The duct static traverse probe shall be of extruded aluminum construction and (except for ¾-inch diameter probes with lengths of 24-inches or less) be complete with threaded end support rod, sealing washer and nut and mounting plate with gasket and static pressure signal fitting.

4. The static traverse probe shall be capable of producing a steady, non-pulsating signal of standard static pressure, without need for correction factors, with an instrument accuracy of 0.5 percent.

5. The duct static pressure traverse probe shall be the STAT-probe/1 as manufactured by the Air Monitor Corporation, Paragon or as approved equal.

D. Air Monitor Electronic Velocity Pressure Transmitters

1. The electronic control-instrument components shall be of industrial process control quality with operating features described herein and capable of producing the outlined performances. Commercial grade control-instruments, devices, are not acceptable.

2. The electronic differential pressure transmitter shall include an automatic zeroing circuit capable of automatically readjusting the transmitter zero at predetermined (adjustable) time intervals while retaining (locking in) the output signal. The electronic differential pressure transmitter shall be capable of receiving signals of duct total and static pressures, and of amplifying and scaling the sensed differential pressure into a 4-20 mADC or 0-5 (0-10) VDC output signal linear to differential pressure, within the following minimum performance criteria:

Zeroing	Automatic, within 0.1 percent of operating span, on 4 to 256 minute intervals (selectable)
Spans	Factory custom spanned, coordinated with system, ranges from 0 to .01-inch to 0 to 10.0-inches. Field adjustment ±20 percent of span.
Accuracy	± 0.25 percent of span
DeadBand and Hysteresis (Combined):	Less than 0.2 percent of span
Linearity:	± 0.2 percent of span
Repeatability:	0.15 percent of span
Response:	0.5 second for 98 percent full span input
Power Supply:	24 VAC, 20 to 40 VDC, selectable; 4 wire

3. Coordinate requirements with the buildings direct digital control system to perform the required sequence of operation.

4. The pressure transmitter shall be the VELTRON series 5000AZ as manufactured by the Air Monitor Corporation, Paragon, Greenheck, or as approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all equipment may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Verify structure, mounting supports and membrane installations are completed to the proper point to allow installation of roof mounted equipment, where applicable.

C. Examine rough-in requirements for all piping systems to verify actual locations of piping connections prior to installation.

D. Verify that electrical work installation is in accordance with manufacture's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until electrical work is acceptable to equipment installer. Coordinate sizes of all thermal overloads with Division 26.

E. Do not proceed until unsatisfactory conditions have been corrected.

F. Provide wiring diagrams of all equipment as specified in Division 23 Section, *Common Work Results for HVAC.*

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install all equipment in accordance with manufacturer's installation instructions, in accordance with state and local code requirements, and in accordance with the contract drawings. Install all equipment plumb and level, to tolerances as required by the manufacturer of each item of equipment. Maintain manufacturer recommended clearances around and over all equipment.

B. Coordinate vibration isolation requirements with all equipment in accordance with Division 23 Section, *Vibration Controls for HVAC, Plumbing and Fire Protection Equipment.*

C. Coordinate all electrical requirements with Division 26.

D. Coordinate all indoor and outdoor equipment pad locations and sizes with approved shop drawing submittals. Provide operating weights of equipment to Structural Engineer for review. Coordinate equipment pad locations and sizes with the Concrete Contractor or General Contractor. Furnish anchor bolts which are to be inserted in concrete pads to concrete installer.

E. Verify piping arrangements of all equipment with the contract drawings. Piping details shall be strictly adhered to concerning valves, fittings, components, etc. At coils, where a rebuildable and repairable autoflow valve is installed in the line without the need for draining or shutting of the water, the same may be utilized as the isolation valve and additional shut-off valve is not required.

F. Connect all equipment, devices and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not

indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

G. Testing: After installing HVAC equipment, devices and components and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

H. Remove and replace malfunctioning units with new units and retest.

I. All mechanical penetrations or terminations in exterior walls shall be flashed and caulked watertight.

J. Arrange for equipment such as energy recovery units, heat pumps to be shipped to project in modules where space constraints require the same. Field erect components as required.

3.03 FIELD QUALITY CONTROL

A. Where indicated provide the services of a factory authorized service representative to examine the field assembly of components, installation, piping, electrical connections, controls, and clearances. Submit factory start-up check list to Engineer for information purposes. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.

B. Where factory start-up of equipment is not specified, provide field start-up by qualified technician to examine the field assembly of components, installation, piping, electrical connections, controls and clearances. Record equipment manufacturers standard start-up information and submit to Engineer for review. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.

C. Charge all refrigerant systems with refrigerant and oil and test for leaks. Repair leaks and replace lost refrigerant and oil.

D. Submit to Engineer a written table of all relief valve and make-up water valve settings for each system. Provide an additional copy in the Operations and Maintenance Manuals.

E. Verify proper motor sizes, voltages, thermal overloads, nameplate data, etc. All equipment voltages and current shall be recorded to insure that motors are operating below their service factors. Test and Balance Engineer shall record electrical data before continuous or permanent operation.

3.04 DEMONSTRATION

A. Where indicated, provide the services of a factory authorized service representative to provide start-up and to demonstrate and train the Owner's maintenance personnel.

B. Place equipment into operation and adjust controls and safeties. Replace damaged or malfunctioning components and controls.

C. Training:

1. Train the Owner's maintenance personnel on start-up and shut-down procedures, trouble shooting procedures, lubrication, servicing procedures and preventative maintenance schedules/procedures. Review with the Owner's personnel, the contents of the operation and maintenance data specified in Division 23 Section, *Common Work Results for HVAC.*

2. Submit operation and maintenance data as soon as possible prior to project close-out. Operations and maintenance data shall be submitted to the Owner for review and comment prior to submission to the Engineer.

3. Schedule training with the Owner through the Architect and/or Engineer with at least seven (7) days prior notice.

D. Contractor shall demonstrate removal and replacement of filters at all pieces of equipment with filters in the prescence of the Owners representative.

3.05 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan and equipment interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils' entering air face.

3.06 ELECTRIC HEATING EQUIPMENT INSTALLATION REQUIREMENTS

A. Examine heating units for compliance with requirements for installation tolerances and other conditions affecting performance of units. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Connect heating units and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

D. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris; repair damaged finishes, including chips, scratches, and abrasions.

3.07 FAN INSTALLATION REQUIREMENTS.

A. Install fans with resilient mounting and flexible electrical leads.

B. Install flexible connections and vibration isolators as specified in Division 23 Section, *Common Work Results for HVAC* and Division 23 Section *Vibration Controls for HVAC, Plumbing and Fire Protection Equipment*. Ensure metal band of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide safety screens/guards on all fans and permanently mount after final testing and balancing.

D. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fans have been test run under operation.

E. Provide sheave required for final air balance.

F. Install fans according to manufacturer's written instructions.

G. Adjust damper linkages for proper damper operation.

H. Adjust belt tension.

I. Lubricate bearings.

J. Replace fan and motor pulleys and belts as required to achieve design conditions.

K. Mount, install, and wire speed controllers for direct drive fans. Speed controllers for direct drive fans shall be mounted adjacent to fan and wired in accordance with the NEC.

3.08 ENERGY RECOVERY VENTILATOR INSTALLATION REQUIREMENTS

A. Examine areas to receive energy recovery units for compliance with requirements for installation tolerances and other conditions affecting performance of energy recovery units. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Install energy recovery units as indicated, according to manufacturer's written instructions.

C. Install CO2 sensor/control/interlock wiring to variable frequency drives and to ATC system. Install global CO2 sensor to monitor ambient outside air CO2 level.

D. Install and interlock high density space CO2 sensors.

E. Install heat wheels so supply and exhaust flow in opposite directions and rotation is from exhaust side to purge section to supply side.

1. Provide access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.

2. Provide removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.

F. Install and interlock outside air flow monitoring station.

G. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

H. Ducts and fan installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

I. Ground Equipment

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

J. After completing system installation, including outlet fittings and devices, inspect and clean exposed finishes. Remove dirt and construction debris and repair damaged finishes.

K. Startup Services: Engage a factory-authorized service representative to commission units as specified below.

1. Energize and verify correct rotation of heat wheels and fans.

2. Adjust seals and purge.

3. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

4. Test refrigerant circuit and controls.

5. Record refrigerant pressures.

6. Verify sequence of operation.

L. Training

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance.

2. Review data in the operation and maintenance manuals. Refer to Division 01

Section, *Demonstration and Training.*

3. Schedule training with Owner, through Architect, with at least 7 days advance notice.

END OF SECTION

SECTION 23 07 01

HVAC INSULATION

PART 1. GENERAL

1.01. RELATED DOCUMENTS

A. This project is to be LEED certified. Refer to Division 01 Section, including "Sustainable Design Requirements", "Construction Waste Managements", and "Commissioning Requirements" for mandatory work which may apply to all contractors, installers, and suppliers.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR 4.2): For products having recycled content, required documentations for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and Credit MR 5.2): For product manufactured, assembled or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.02. REFERENCE

A. The Conditions of the Contract and other General Requirements apply to the work specified in this Section. All work under this Section shall be subject to the requirements of Division 23 Section, *Common Work Results for HVAC*.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

1.03. DESCRIPTION

A. All piping, ductwork and equipment installed under this Contract shall be covered as specified.

1.04. SCOPE

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of thermal insulation applied to all piping, equipment, and duct systems, in accordance with applicable project specifications and drawings, subject to the terms and conditions of the contract.

1.05. STANDARDS

A. Thermal insulation materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or use:

1. American Society for Testing of Materials Specifications:

a). ASTM C 547, "Standard Specification for Mineral Fiber Preformed Pipe Insulation".

b). ASTM C 533, "Standard Specification for Calcium Silicate Pipe & Block Insulation".

c). ASTM C 55, "Standard Specification for Mineral Fiber Blanket and Felt Insulation".

d). ASTM C 585, "Recommended Practice for Inner and Outer Diameters of Rigid Pipe Insulation for Nominal Sizes of Pipe and Tubing (NPS System)".

e). ASTM C 612, "Standard Specification for Mineral Fiber Block and Board Thermal Insulation".

f). ASTM C 1136, "Standard Specification for Barrier Material, Vapor, "Type 1 or 2 (Jacket only).

g). ASHRAE 90.1 "Energy efficient design of new buildings except low-rise residential buildings", latest edition.

B. Insulation materials, including all weather and vapor barrier materials, closures, hangers, supports, fitting covers, and other accessories, shall be furnished and installed in strict accordance with project drawings, plans, and specifications.

1.06. SYSTEM PERFORMANCE

A. Insulation materials furnished and installed hereunder should meet the minimum economic insulation thickness requirements of the North American Insulation Manufacturers' Association (NAIMA) (formerly known as TIMA), to ensure cost-effective energy conservation performance. Alternatively, materials should meet the minimum thickness requirements of National Voluntary Consensus Standard 90.1, (latest edition) and "Energy Efficient Design of New Buildings," of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), latest edition. However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor. As minimum, all insulation thicknesses shall be as hereinafter specified.

B. Insulation materials furnished and installed hereunder shall meet the fire hazard requirements of any one of the following specifications:

1. American Society for Testing of Materials ASTM E 84

2. Underwriters' Laboratories, Inc. UL 723

3. National Fire Protection Association NFPA 255

C. Calcium silicate products shall include a visual identification system to permit positive field determination of their asbestos-free characteristics.

1.07. QUALITY ASSURANCE

A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications listed in Section 1.4 above.

B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

1.08. DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The Contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The Contractor shall also use all means necessary to protect work and materials installed by other trades.

C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the Contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer in writing for technical assistance.

D. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements. Protect all insulation from water, construction traffic, dirt, chemical and mechanical damage.

1.09. ALTERNATES

A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

1.10. LEED REQUIREMENTS

A. Refer to Division 01 Section LEED Requirements for description of work under this Division affected by LEED requirements.

1.11. LEED SUBMITTALS

A. Product data for EQ 4.1: For adhesives and sealants applied within the building water

proofing envelope, documentation including printed statement of VOC content in g/L.

B. Product data for EQ 4.2: For mastics applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.

PART 2. PRODUCTS

2.01. GENERAL

A. All materials to be insulated shall be thoroughly cleaned, after completion of successful tests, and shall be covered as specified below. Fiberglass insulation shall be Owens-Corning, Manville, Armstrong, or P.P.G, or as approved equal.

2.02. PIPE INSULATION MATERIALS

A. Unless otherwise noted, insulation shall be one piece or half sectional molded fibrous glass with "K" rating of .23 at 75 degrees Fahrenheit mean temperature, for service temperatures between -60 degrees Fahrenheit and +450 degrees Fahrenheit with all service jacket. Pipe insulation shall be fiberglass SSL II with double closure system as manufactured by Owens Corning, Johns Manville, Knauf or approved equal.

B. Exterior refrigerant pipe insulation shall be Armacell, or approved equal, foam insulation with exterior field applied aluminum jacketing. Interior refrigerant piping shall be Armacell or approved equal foam insulation. Where interior refrigerant piping is exposed also install field applied PVC jacketing.

C. Unless otherwise noted, pipe insulation jacket shall be factory-applied vinyl coated, embossed and reinforced vapor barrier laminate, with a perm rating of not more than 0.02 perms. All hot and cold, concealed and exposed butt strips shall be of the same material as the jacket. Jacket and butt strips shall be sealed with field-applied Benjamin Foster adhesive. Jacket and butt strips shall be off-white color and shall be equivalent to Owens-Corning Fiberglass 25-ASJ.

D. All pipe insulation, jackets, or facings, and adhesives used to adhere jacket or facing to the insulation, including fittings and butt strips, shall have non-combustible fire and smoke hazard system rating and label as tested by ASTM E-84, NFPA 225, and UL 73, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50. Accessories such as adhesives, mastic cements, tapes and cloth for fittings shall have the same ratings as listed above. All products or their shipping cartons shall bear the Underwriter's label indicating that flame and smoke ratings do not exceed the above criteria.

E. For piping having a vapor barrier insulation and for all insulated piping requiring supports, hangers and supports shall be installed outside the insulation. Wherever hangers and supports are installed outside the insulation, pipe insulation protecting shields shall be provided. Where insulation is a load bearing material, of sufficient strength to support the weight of the piping, pipe shields one-third the circumference of the insulation and of a length not less than three times the diameter of the insulation (maximum length 24-inches) shall be provided. Insulation of 7-1/4 pound or greater density will be considered as load bearing for pipe sizes up to and including 2-inches. Where insulation is not of sufficient strength to support the weight of the piping, a half section of high density fiberglass or foam

inserts, shall be provided. Vapor barrier and finish shall be applied as required to match adjoining insulation. In addition, shields shall be furnished as specified above.

F. For piping located outside of the building, an corrugated aluminum weatherproof jacketing system shall be provided. This system shall be Micro-Lot ML as manufactured by Manville, Polyweld by Pabco Metals Corp., Childers, or as approved equal, and installed per the manufacturer's recommendations. Where outdoor piping is receiving electric heat tape, the insulation shall be oversized so that the heat tape is not compressed tightly to the pipe. Pipe jacketing shall be corrugated (3/16-inch) deep aluminum, .016-inch thickness of H-14 temper with aluminum strapping of .75-inch width and .020 inch thickness with moisture barrier. Aluminum jacketing elbows shall be smooth, .016-inch thickness and 1100 alloy. All jacketing shall have an integrally bonded moisture barrier over the entire surface in contact with the insulation. Longitudinal joints shall be applied so they will shed water and shall be sealed completely. Circumferential joints shall be closed using preformed butt strips following manufacturer's recommendations for securement. Jacket seams shall be located on the bottom side of the horizontal piping.

G. On cold systems such as refrigerant piping cooling coil drain piping, vapor barrier performance is extremely important. All penetrations of the ASJ and exposed ends of insulation must be sealed with vapor barrier mastic. The ASJ must be protected with either a mastic coating or a suitable vapor retarding outer jacket. Vapor seals at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion.

H. Fittings and valves shall be insulated with pre-formed fiberglass fittings, fabricated sections of fiberglass pipe insulation, Fiberglass pipe and tank insulation, Fiberglass blanket insulation, or insulating cement. Thickness shall be equal to adjacent pipe insulation. Finish shall be with pre-formed PVC fitting covers or as otherwise specified on contract drawings. Where applicable, Victaulic PVC fitting valve and coupling covers shall be utilized. Victaulic PVC covers shall be installed with matching pipe insulation jacketing material, vinyl tape solvent weld adhesive and appropriate fasteners.

1. Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with a suitable weather or vapor-resistant mastic as dictated by the system location and service. Finish valve installation with a Tyvac jacket with ends that secure to adjacent piping.

2. On cold systems, particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. All valve stems must be sealed with caulking which allows free movement of the stem but provides a seal against moisture incursion. All gauge and thermometer penetrations and extensions shall be correctly sealed and insulated to prevent surface condensation. Install oversized hangers to prevent penetrations of pipe insulation vapor barrier.

I. All piping shall be supported in such a manner that neither the insulation or the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases,

hanger spacing must be such that the circumferential joint may be made outside the hanger. On cold systems, vapor barrier must be continuous, including material covered by the hanger saddle.

1. Piping systems 3-inches (7.5cm) in diameter or less, insulated with Fiberglass insulation, may be supported by placing saddles of the proper length and spacing, as designated in Owens-Corning Pub. 1-IN-12534, under the insulation. Hangers saddles shall be minimum 16 gauge with a saddle arc of 120 degrees minimum.

2. Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.

3. Thermal expansion and contraction of the piping and insulation system shall generally be taken care of by utilizing double layers of insulation and staggering both longitudinal and circumferential joints. Where long runs are encountered, expansion joints may be required where single layers of insulation are being used and should be so noted on the contract drawings.

4. On vertical runs, insulation support rings shall be used.

2.03. PIPING INSULATION THICKNESSES SCHEDULE

A. All piping shall be insulated with pipe insulation of the thicknesses indicted below:

PIPING INSULATION THICKNESS SCHEDULE SERVICES	THICKNESS
All Drain Piping from Cooling Coils/Evaporators	½-inch thickness
All Refrigerant Piping	1 ½ -inch thickness

2.04. DUCTWORK INSULATION MATERIALS AND THICKNESSES

A. Insulate all supply, return, exhaust, (for ERV projects) and outside air intake ductwork with fiberglass exterior duct insulation with factory-applied foil facing. All exposed fiberglass duct insulation shall be 1-1/2-inch rigid or non-flexible board type 3.0 pcf minimum density, 0.23 max. "K" factor at 75 degrees F mean temperature, with white vinyl A.S.J. vapor barrier facing. All concealed fiberglass duct insulation shall be 1-1/2-inch flexible blanket type, 1.0 pcf minimum density. All concealed insulation shall be 0.27 max. "K" factor at 75 degrees F mean temperature with reinforced foil-scrim Kraft vapor barrier facing.

B. Refer to Division 23 Section, *HVAC Air Distribution System* and contract drawings for location of all sound-lined ductwork. Sound-lined ductwork from the discharge or supply side of all energy recovery units shall require external insulation in addition to internal lining specified hereinafter. All other ducts indicated to be provided with interior lining shall not require additional exterior insulation.

C. Where a vapor barrier is required, all joints, seams, tears, punctures, and other penetrations shall be closed with 3-inch (7.5cm) pressure-sensitive tape matching the facing or with vapor barrier mastic reinforced with 3-inch (7.5cm) glass scrim tape.

D. Contractor-applied internal linings shall be as specified and installed as hereinafter specified.

E. For exposed Fiberglass duct insulation, tightly butt all edges and seams. Secure insulation with flush mechanical fasteners spaced not less than one per square foot. Insulation may be secured with 100 percent coverage of adhesive with mechanical fasteners on the underside of the duct only, in addition to adhesive. Cover all seams, joints and fasteners with not less than 3-inch wide tape matching the insulation facing. Pre-finished white fastener caps may be left exposed if the spacing and pattern is uniform in appearance. Staples will not be permitted.

F. All supply air diffusers and supply air registers shall be fully insulated on the rear exposed surface to prevent condensation. Insulation shall be 1 ½" inch flexible blanket type 1 ½ pcf minimum density with reinforced foil-scrim-Kraft vapor barrier facing, .25 max "k" factor.

2.05. ACCESSORY MATERIALS

A. Accessory materials installed as part of insulation work under this section shall include, but not be limited to:

1. Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives; pressure-sensitive tapes.

2. Field-applied jacketing materials - sheet metal, plastic, canvas, fiber glass cloth, insulating cement; PVC fitting covers, PVC jacketing.

3. Support Materials - Hanger straps, hanger rods, saddles.

4. Fasteners, weld pins/studs, speed clips, insulation washers.

5. Metal mesh or expanded metal lagging.

B. All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards."

2.06. FIELD-APPLIED JACKET

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a). Johns Manville; Zeston.
b). P.I.C. Plastics, Inc.; FG Series.
c). Proto PVC Corporation; LoSmoke.
d). Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: High gloss white

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a). Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

PART 3. EXECUTION

3.01. WORKMANSHIP

A. The Contractor shall take special care to prevent soiling equipment below or adjacent to areas being insulated. He shall be completely responsible for removing insulation cement splashes and smears and all surfaces that he mars or otherwise soils or defaces, and he will be totally responsible for restoring these damaged surfaces to their like-new condition when delivered to the site.

3.02. SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.03. PREPARATION

A. Ensure that all pipe and equipment surfaces over which insulation is to be installed are clean and dry.

B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

C. Ensure that pressure testing of piping or duct systems has been completed prior to installing insulation.

3.04. INSTALLATION

A. Piping Systems

1. General:

a). Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.

b). Install insulation on piping subsequent to installation of heat tracing, painting, testing, and acceptance tests.

c). Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.

d). Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tear or other damage. Seal all tears, punctures and other penetrations of the pipe insulation vapor barrier facing.

e). On exposed piping, locate insulation and cover seams in least visible location.

2. Fittings: Cover valves, fittings, unions, flanges, strainers, flexible connections, expansion joints, pump bodies, strainers, blowdowns, backflow preventers, autoflow valves and similar items in each piping system using one of the following:

a). Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.

b). Insulation cement equal in thickness to the adjoining insulation.

c). PVC fitting covers insulated with material equal in thickness and composition to adjoining insulation.

3. Penetrations: Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise specified.

4. Joints:

a). Butt pipe insulation against hanger inserts. For hot pipes, apply 3-inch (7.5cm) wide vapor barrier tape or bank over butt joints. For cold piping, apply wet coat of vapor barrier lap cement on butt joints, and seal joints with 3-inch (7.5cm) wide vapor barrier tape or band.

b). All pipe insulation ends shall be tapered and sealed, regardless of service.

B. Ductwork Insulation:

1. General:

a). Before installing insulation, ensure that all seams and joints in ductwork have been sealed and leak tested by the contractor responsible for the duct system. Before applying duct insulation, air ducts shall be clean and dry.

b). Install insulation in accordance with manufacturer's published instructions and recognized industry practice to ensure that it will serve its intended purpose.

c). Install insulation materials with smooth and even surfaces. Butt joints firmly together to ensure complete and tight fit over surfaces to be covered.

d). Maintain the integrity of factory-applied vapor barrier jacketing on all insulation, protecting it against puncture, tears or other damage. All staples used on ductwork insulation shall be coated with suitable sealant to maintain vapor barrier integrity and covered with pressure sensitive vapor barrier tape.

e). Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and exposed joints. All portions of duct designated to receive duct wrap shall be completely covered with duct wrap.

f). To ensure installed thermal performance, duct wrap insulation shall be cut to "stretch-out" dimensions. Maintain specified duct insulation thickness and vapor barrier at all fittings, obstructions, and duct flanges.

g). A 2-inch (50mm) piece of insulation shall be removed from the facing at the end of the piece of duct wrap to form an overlapping stapling and taping flap.

h). Install duct wrap insulation with facing outside so that the tape flap overlaps the insulation and facing at the other end of the piece of duct wrap. Adjacent sections of duct wrap insulation shall be tightly butted with the 2-inch (50mm) stapling and taping flap overlapping. If ducts are rectangular or square, install so insulation is not excessively compressed at corners. Seams shall be stapled approximately 6-inches (150mm) on center with 2-inch (13mm) (min) steel outward clinching staples.

i). Seams, joints and staples shall be sealed with pressure-sensitive tape matching the insulation facing (either plain foil or FRK backing stock) or glass fabric and mastic. Cloth duct tape of any color or finish using reclaimed rubber adhesives shall not be utilized on duct wrap insulation. Adjacent sections of duct wrap shall be tightly butted with the 2-inch (50mm) tape flap overlapping.

j). Where rectangular ducts are 24-inch (600mm) in width or greater, duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers, spaced on 18-inch (425mm) centers (maximum) to prevent sagging of insulation.

k). Seal all tears, punctures and other penetrations of the duct wrap facing using one of the above methods to provide a vapor tight system.

l). Upon completion of installation of duct wrap and before operation is to commence, visually inspect the system and verify that it has been correctly installed.

m). Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means for removal of such material.

n). Check the duct system to ensure that there are no air leaks through joints.

o). No ductwork insulation shall be supported utilizing tie wire or bailing wire. Penetrations of ductwork insulation vapor barrier are prohibited.

p). Bevel and terminate insulation at access doors. Paint edges with vapor barrier mastic.

q). Install insulation board between volume dampers and sheet metal standoffs.

r). Provide removable insulation section at all pitot tube traverse points. Insulation section shall contain tether that attaches to adjacent ductwork.

2. Penetrations: Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise specified.

3. Ductwork Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by the insulation manufacturer.

4. Rigid Insulation:

a). Rigid duct insulation may be impaled over welded pins and secured with insulation caps and washers matching the color of the vapor barrier facing. All seams shall be firmly butted and sealed with pressure-sensitive vapor barrier tape matching the facing.

b). Corner angles shall be installed on all external corners of rigid duct insulation in exposed finished areas before jacketing, except oven and hood exhaust duct insulation, which shall have no corner angles.

5. Duct Wrap Insulation: Duct wrap insulation shall be applied with all joints butted firmly together. All joints in the insulation covering shall be sealed with adhesive. Duct wrap insulation shall be secured to bottom of rectangular or oval ducts over

24inches (60cm) wide with mechanical fasteners on 16-inch (40 cm) (approx.) centers to prevent sagging.

6. Duct Lining Insulation: Duct liner insulation shall be applied with all joints tightly butted using 90 percent coverage of adhesive meeting the requirements of ASTM C 916 plus mechanical fasteners spaced according to the liner manufacturer's schedule for the interior width of the plenum, housing, or air shaft. (Also refer to Division 23 Section, *HVAC Air Distribution System*.)

3.05. FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.06. PROTECTION

A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.07. SAFETY PRECAUTIONS

A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.

B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.08. INSULATION COVERING

A. Unless otherwise noted, all exposed duct and equipment insulation shall have a field applied PVC jacket cover neatly cut and pasted over ductwork and equipment insulation. PVC shall be high gloss white and shall be 20 mils thick.

B. Unless otherwise noted, all exposed pipe insulation required to be insulated shall be jacketed with a PVC Jacketing with fitting covers. PVC jacket shall be color fade resistant, white high gloss, U.S.D.A. authorized as manufactured by Proto Corporation or approved equal. PVC jacketing shall be high impact, ultraviolet resistant PVC. Minimum thickness shall be 20 mils, roll stock ready for shop or field cutting and forming.

C. Exposed areas include, but are not limited to, all mechanical equipment rooms/fan rooms, electric rooms, piping and ductwork exposed in an occupied space.

D. Where PVC jackets are indicated, install with 1 inch overlap at longitudinal seams and end joints, for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Exterior exposed pipe insulation required to be insulated shall be jacketed with a corrugated aluminum jacketing system as previously described.

END OF SECTION

SECTION 23 09 00

AUTOMATIC TEMPERATURE CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. For General Mechanical Requirements, see Division 23 Section, *Common Work Results for HVAC*, and Division 01, *General Requirements*.

B. Comply with all code requirements and fire safety requirements as specified in Division 21 Section, *Common Work Results for Fire Protection.*

C. Coordinate controls with controlled equipment. Upon completion of the work, calibrate and adjust all controls for proper function. Electric wiring, including interlock wiring for equipment such as ERV's, heat pumps, exhaust fans, ductless units, fans, switches, dampers, etc., shall be furnished and installed under this section. All electrical work shall conform to the applicable requirements of Division 26. All control wiring shall be installed in conduit in accordance with Division 26.

D. Reference is hereby made for this contractor to become familiar with Division 26 of these specifications. Familiarization is for coordination purposes only. The control contractor shall provide all necessary relays, manual override switch, contactors, interlock wiring etc. not provided under Division 26 for the automation of the control systems as required by the sequence of operation. The Mechanical Contractor shall coordinate all requirements with the building Fire Alarm System. The mechanical contractor shall provide all additional devices and interlock wiring required for the automation of the ATC system.

E. Furnish all labor, materials, equipment and services necessary for and incidental to furnishing and installing a complete stand-alone, automatic control system to meet the requirements of the sequence of operation described in Part 4.

F. All labor, material, and equipment to meet the functional intent of the system, as specified herein and as shown on the drawings, shall be included. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, that are required to meet the functional intent, shall be provided without additional cost to the owner.

G. Furnish and install all wiring controls, programming, devices, and equipment to interlock all of the new outbuildings with the ATC system in the Main Dover High School. The ATS system in the main Dover High School is a web based system.

1.02 QUALITY ASSURANCE

A. The systems shall be complete in all respects, and shall be installed by skilled personnel. The Mechanical Contractor shall have a successful history in the installation and maintenance of automatic temperature control systems similar in size and performance to that specified herein.

B. All electrical wiring in connection with the Automatic Temperature Control System shall be

furnished and installed by the Mechanical Contractor. This shall include all interlock wiring between the ERVs, exhaust fans, electric unit heaters, fans, pumps, dampers, and switches.

C. All temperature control and interlock wiring shall be installed in conduit unless otherwise noted on the plans. Power or interlock wiring shall be run in separate conduit from sensor and communications wiring.

D. Identify each item, mounted on the face of a control panel, with an engraved nameplate (1/4") inch high engraved letters minimum). Identify each item of control equipment (except room sensors and thermostats), with stamped tape, firmly attached to equipment (1/4") inch high letters minimum).

E. Thermostats or sensors mounted on outside walls shall be mounted on 1 inch minimum thickness, rigid fiberglass insulating base (or equal).

1.03 GUARANTEE AND INSTRUCTION

A. The control system including all components, parts and assemblies herein specified shall be free from defects in workmanship and materials under normal use and service. After completion of the installation, the Mechanical Contractor shall regulate and adjust all thermostats, control valves, control motors, and other equipment provided under this contract. If within two (2) years from the date of acceptance by Owner any of the equipment herein described is proved to be defective in workmanship or materials, it will be replaced or repaired at no additional cost to the Owner. The Mechanical Contractor shall, after completion, provide any service incidental to the proper performance of the Control System under guarantees outlined above for a period of two (2) years. Normal maintenance of the system is not to be considered part of the guarantee. All corrective modifications made during warranty service periods shall be updated on all user documentation including *as-built* shop drawings.

B. The mechanical contractor shall completely check out, calibrate and test all equipment to insure that the system performs in accordance with the approved specifications and sequences of operation submitted.

C. Upon completion of the work, the control drawings encased in heavy plastic shall be provided where directed. Layout shall show all control equipment and the function of each item indicated.

D. Upon completion of the work, the Mechanical Contractor shall have completely adjusted the entire control system. He shall arrange to instruct the Owner's representative on the operation of the control system for a period of not less than eight (8) hours. All training shall be by the Mechanical Contractor and shall utilize specified manuals and as-built documentation.

1.04 SUBMITTALS

A. Submit complete shop drawings, including component catalog cuts, for approval before starting any control work. Shop drawings shall be in accordance with Division 23 Section, *Common Work Results for HVAC*. Shop drawings shall indicate all control equipment, arrangements, locations, functions, and description of operation.

B. Upon completion of his work, the Control Contractor shall provide six (6) sets of description of operation and schematic drawings corrected to the as-built condition. This material shall be delivered to the Owner.

C. Submittal shall consist of:

1. Data sheets of all products.
2. Damper, and well and tap schedules showing size, configuration, capacity and location of all equipment.
3. Wiring and piping interconnection diagrams including panel and device power and sources.
4. Equipment lists of all proposed devices and equipment.
5. Sequences of operation.

1.05 ALTERNATES

A. Refer to Division 01 Section, *Alternates* - Alternates for description of work under this section affected by alternates.

1.06 LEED REQUIREMENTS

A. Refer to Division 01 Section LEED Requirements for description of work under this Division affected by LEED requirements.

PART 2 PRODUCTS

2.01 WIRING

A. The multi-conductor cable for field wiring of electronic analog sensors shall be minimum No. 22 AWG, 300 volt, thermoplastic with stranded copper wire and 100% shield coverage. The number of conductors in each sensor cable shall be as determined by the Contractor. 2/c #22 shielded cables shall be Belden Cat. #8451 3/c #20 shielded cables shall be Belden Cat. #9770.

B. Individual conductors shall be color coded and in addition shall be numbered in the field to identify the particular terminal to which attached. Field numbering shall be performed with Brady markers wrapped around the wire near the terminal connection. All wires shall be terminated with pressure type connectors suitable for wire size, material and terminal connection.

C. All wiring shall be installed in a designated conduit raceway. The conduit shall conform to Division 26.

D. All junction boxes shall have covers painted *safety green*, and be rigid steel.

2.02 CONTROLLERS

A. Temperature sensor covers shall be locking type, key to open with blank cover. All room temperature sensor shall be mounted 5'-3 inches above the furnished floor, except in

corridors and toilets, which shall be 7'-0 inches. Provide insulating bases where temperature sensors are located on exterior or unconditioned walls. Each temperature sensors shall have adjustable limit stops and adjustable sensitivity. Provide vandal proof locking covers.

2.03 DAMPERS

A. Control Dampers

1. The Mechanical Contractor shall provide all automatic control dampers of the types indicated on the plans and not specified to be integral with other equipment. Frames shall be not less than 16 gauge galvanized steel. Blades shall not be over 6 inches wide airfoil shaped double skin construction of 14 gauge equivalent thickness. Bearings shall be stainless steel sleeves with ½" inch shafts. Blade edge seals shall be vinyl blade with flexible metal compressible jamb seals of the tight-seal spring type. Dampers and seals shall be suitable for temperature ranges of -40 to 250 degrees F.

2. All proportional control dampers shall be opposed blade type and all two-position dampers shall be parallel blade type.

3. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6 inches.

4. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage and flow characteristic data for all control dampers with the temperature control submittal. Maximum leakage shall be 3 CFM/Sq. Ft. at static pressure of 1 inch W.C. for a damper width of 48 inches.

5. Where ultra-low leakage dampers are specified the blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage to 1/2 percent at applied static pressure.

6. Low pressure rectangular control dampers shall be Type CD60 airfoil low leakage damper as manufactured by Ruskin or as approved equal of American Warming and Ventilating, Air Balance and Arrow. Round control dampers shall be Type CERS25 with blade edge seals as manufactured by Ruskin or as approved equal.

B. Damper Operators

1. Electric damper actuators shall be properly sized to provide sufficient torque to position the damper throughout its operating range.

2. Use devices which are quiet in operation and which in the event of power failure, will *fail safe* by spring action in either the normally open or normally closed position as required for freeze, moisture, smoke, or fire protection.

3. In general, where operators are sequenced with other operators they shall be provided with positive positioning relays having adjustable operating ranges and starting points to permit adjustment of the control sequence as required by the

operating characteristics of the system. However, where operators for sequencing valves are located in confined spaces within terminal units, springs with pre-selected ranges to provide necessary sequencing may be used.

4. Electric actuators requiring a 24 VAC power supply will be utilized. All motors will have a cover mounted 120/24VAC transformer. Motors shall be specifically designed and sized with proper torque according to requirements of the device it is to be used on (i.e.: valve, damper). Each actuator will accept the proper control input as the system is designed, (i.e.,: floating, 0-10VDC, 4-20Ma etc.) without the need for any additional interface devices.

2.04 CONTROL PANELS

A. Where required or indicated furnish and install local panels for indicating controllers, switches, relays, etc. Control panels shall be fully enclosed cabinets, all steel construction and shall meet the requirements of NEMA 1 enclosures. Cabinet shall have piano hinged door with a locking latch. All cabinet locks shall use common key. Provide means of storing control system instructions and drawings inside cabinet for future reference. Panel shall be wall mounted or free standing and located where directed by the Contract Drawings or Engineer. All gauges and switches in the face of panels shall be identified with micarta nameplates with etched white filled letters not less than one (1) inch high.

2.05 MISCELLANEOUS ELECTRICAL DEVICES

A. Electric Actuators. All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with electric actuators which shall be sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close off as specified.

1. Where two or more actuators are to be operated in sequence with each other, sequencing shall be by spring range, pilot positioners, or by digital sequencing with separate analog outputs, as specified in the sequence of operation.

B. Aquastats shall be line voltage strap on type with single pole, single throw switching. Switches shall have an adequate rating for the applied load. All wiring from aquastats to domestic recirculating pumps shall be by Mechanical Contractor.

C. Duct Smoke Detectors shall be furnished by Division 26 and installed under Division 23. They shall be designed to provide detection of combustion gases and fire and smoke in air conditioning and ventilating duct systems in compliance with the National Fire Protection Association and Underwriters Laboratories, Inc. Standard U.L. 167.

D. Unless otherwise specified, for low voltage circuits, use NFPA 70 Type T, TF, TW, THW, THWN, R, RH, RF-2, or FF-2 of 20 gauge and larger except low voltage dc and electronic circuits carrying less than 0.5 amperes cables 2 of 2 or more conductors, not smaller than 22 gauge if not shielded, may be used in lieu of individual wires. Use shielded cables carrying circuits sensitive to external fields. Terminate cables in push-on, solder or screw type terminal strips. Do not tap cables at intermediate points. Do not create intermediate junction points.

E. Provide E.M.T. raceway systems for all wiring in accordance with NFPA 70, and Electrical Specification, Division 26. Wiring shall be plenum rated in areas of mechanical air transfer.

F. Relays shall be open contact, electronic type with dust-proof enclosures having capacity suitable for the load controlled.

G. Provide all necessary wiring, relays, contacts, etc., to prevent nuisance alarms of alarm points during *Off, Unoccupied or Test* modes.

H. Transformers other than those used in bridge circuits shall have primaries wound for the correct control circuit voltage. Size to have capacity to operate simultaneously all apparatus served and in addition be capable of carrying a 25 percent overload for one hour. Enclose transformer in a steel cabinet with conduit connections, and provide a disconnect switch on the primary side, and a fuse cut-out on the secondary side.

I. Operate electric and electronic mechanical controls at maximum of 120 volts or less. Where not provided under Division 26, Electrical, provide voltage transformers and isolating relays where control system must operate at voltage other than that of line voltage.

J. Wiring shall be performed in accordance with the applicable provision of Division 26, Electrical Work. All temperature control wiring shall be run in E.M.T. in mechanical spaces in raceway and in accordance with Division 26. Furnish plenum rated cable in all areas of mechanical air transfer.

K. Low voltage cable may be utilized in accessible locations. This cable shall be run *open* and ty-wrapped accordingly.

2.06 SPACE TEMPERATURE SENSORS

A. Space temperature sensors for unit heaters, and other temperature dependent equipment shall be single stage, low voltage, DDC compatible sensors that can be interfaced with the ATC system. Furnish units with 50 degree to 80 degree F adjustable range.

B. Provide transformers as necessary to accomplish sequence of operation.

C. Provide locking vandal-proof covers on all space temperature sensors.

D. All space temperature sensor shall be programmed to provide occupied/unoccupied settings, start/stop optimization, remote re-set, and shall be interlocked and report to the DDC system.

2.07 MISCELLANEOUS DEVICES

A. Aquastats shall be line voltage strap-on type for single pole, single throw switching. Aquastats shall be provided, wired, and installed by mechanical contractors.

PART 3 EXECUTION

3.01 GENERAL

A. The Automatic Temperature Control System shall be designed, installed, and commissioned

in a turn key fully implemented and operational manner.

3.02 INSTALLATION & SUPERVISION

A. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All piping and wiring within enclosures shall be neatly bundled and anchored to prevent restriction to devices and terminals.

B. The Mechanical Contractor shall be responsible for all electrical installation required for a fully functional control and automation system and not shown on the electrical plans or required by the electrical specifications. All wiring shall be in accordance to all local and national codes.

1. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the electrical specifications.

2. All electric and electronic wiring shall be #18 AWG minimum THHN and shielded if required.

C. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

D. Install in accordance with manufacturers instructions.

E. Check and verify location of temperature sensors, humidity sensors, and other exposed control sensors with plans and room details before installation. Align with lighting switches.

F. Provide separable sockets for liquids and flanges for air bulb elements.

G. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

3.03 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as ERV units and VRV systems.

F. Verify that conditioned power supply is available to the control units. Verify that field end

devices, wiring, and tubing is installed prior to installation proceeding.

3.04 INTERLOCK REQUIREMENTS

A. The fan and equipment interlock requirements are as required herein and as scheduled on the contract drawings.

B. Furnish and install all necessary relays, transformer, contactors, wiring, conduit, and accessories to perform fan and equipment interlocks.

C. Unless otherwise noted, fan interlocks shall be arranged such that dampers associated with fan shall be open when fan starts and close when fan stops.

3.05 SUBMITTALS FOR REVIEW

A. Shop Drawings: Indicate mechanical system controlled and control system components.

1. Label with settings, adjustable range of control and limits. Include written description of control sequence.
2. Include flow diagrams for each control system, graphically depicting control logic.

3.06 SUBMITTALS AT PROJECT CLOSEOUT

A. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 4 SEQUENCES OF OPERATION

4.01 ELECTRIC DOMESTIC HOT WATER HEATER WITH RE-CIRC PUMP.

A. General

1. The electric domestic hot water heaters shall be tied into the ATC system to provide start/stop optimization and control. ATC contractor shall provide contactors as required for start/stop optimization. Water heater systems in buildings that will be drained down in the winter shall be interlocked with ATC system to allow remote start/stop of water heater and recirc pump.

2. The leaving water temperature of each water heater shall be monitored and report back to central monitoring system.

3. Each domestic hot water heater re-circ pump shall be controlled by a line mounted aquastat. All wiring, relays, aquastats, etc., shall be provided and installed by ATC subcontractor. Domestic water re-circulating pumps shall be de-energized when system is shut-down during summer and/or lengthy unoccupied periods.

4. On a fall in recirc. water temperature below set point the recirc. pump shall energize. Reverse sequence shall occur when aquastat is satisfied.

5. Provide and install differential pressure switch or current sensor to determine the status of all domestic re-circ pumps.

B. System Operation

1. Each electric domestic water heater shall be furnished with factory package controls to maintain a constant leaving temperature of 110 degrees F (adjustable)

4.02 ELECTRIC UNIT HEATERS

A. General

1. The electric unit heaters shall be provided with DDC controls to allow programmable start/stop occupied/unoccupied schedules, manual override, and remote set point adjustable.

2. The ATC subcontractor shall install controls, interlock wiring, sensors, and control wiring for a complete and operational system.

3. The unit heater occupied periods and setpoints shall be programmed into the DDC system with the Owner's input. Unit heaters shall only operate in occupied mode when activated automatically via DDC system or by manual override switch.

B. System Operation:

1. On a fall in room temperature to 70 degrees F (adjustable), the space sensor, T-1 shall energize unit heater fans and heating elements in sequence to maintain a space temperature of 70 degrees F (adjustable). The reverse sequence shall occur upon a rise in space temperature above set point.

2. During unoccupied periods the space temperature sensors shall be reset to an unoccupied temperature of 55°F (adjustable) and the fan/heating elements shall cycle to maintain the unoccupied setting.

C. Manual Override Control

1. All unit heaters in each building shall be interlocked with a manual override switch that will ignore the pre-programmed known events/schedules. The manual override control switch shall allow all of the unit heaters in a building to be manually overridden from unoccupied mode to occupied mode for a pre-programmed time period (90 minutes – adjustable). Label the common switch in each building as the "heating system manual override switch".

2. Furnish and install a manual override switch (in each outbuilding containing unit heaters) that when activated will enable all of the unit heaters in the same outbuilding to be changed from unoccupied mode to occupied mode. The unit

heaters shall operate to maintain the occupied setpoints for a timed period (90 minutes – adjustable) regardless of the known event program schedule.

3. The reverse sequence shall occur when the heating system manual override switch is de-energized.

4. All wiring from heating system manual override switch to unit heaters, DDC system, etc… shall be installed under this Division of specifications.

4.03 EXHAUST FANS (EXHAUST FAN #1, 2, & 3)

A. General

1. Whenever the exhaust air fan is energized, associated motor operated damper, D-1 shall be in wide open position.

2. The motor operated damper shall fail in the closed position.

3. Provide differential pressure sensor or current sensor to determine status of each exhaust air fan.

4. Interlock exhaust fans with DDC system to allow automatic scheduling for known events. Whenever a known event is scheduled on the DDC system the exhaust fans shall operate for a fixed, software timed period. Once the known event is over the exhaust fans shall return to the off position.

5. Coordinate with Owner to program all known events and times for exhaust fans to be operational.

B. Manual Override Control:

1. The exhaust fans listed above shall each also have provisions for a manual override that will ignore the pre-programmed known events/schedules. The manual override control shall allow the outbuilding exhaust fans to be manually energized for a pre-programmed time period 90 minutes (adjustable). Label the switch as “Exhaust Fan Manual Override Switch”.

2. Furnish and install a manual override switch that when activated shall provide building occupants with a timed period 90 minutes (adjustable) where the exhaust fan is operational regardless of the known event programmed schedule. When the manual override switch is activated the exhaust fan motor operated damper, D-1, shall open and the exhaust fan shall operate continuously for the timed period (90 minutes – adjustable).

3. The reverse sequence shall occur when the manual override wall switch is de-energized.

4. All wiring from manual override switch to fan/damper shall be installed under this Division of specifications.

4.04 VARIABLE REFRIGERANT VOLUME SPLIT SYSTEM AIR COOLED SYSTEMS

A. The variable refrigerant volume split system shall be provided with factory furnished controls as indicated in Division 23 Section, *Heating, Ventilation, and Air Conditioning*.

B. Under this Division install all factory furnished controls, communication wiring, interlock wiring, sensors, thermostats, and control wiring for a complete and operational system.

C. Refer to point list on Contract Drawings for additional monitoring requirements.

D. ATC Subcontractor shall interlock the A/C condensate float switch to their respective ductless split system indoor unit. The A/C condensate float switch shall be wired to de-energize the indoor unit if moisture is detected in the auxiliary drain pan. A remote alarm shall be annunciated upon activation of the float switch, through the ATC system.

E. Provide occupied and unoccupied scheduling that will allow the variable refrigerant volume split system to be de-energized during unoccupied periods. During unoccupied periods the variable refrigerant volume split system shall only be energized if any unoccupied or setback temperature is not met. Once the unoccupied or setback temperatures are met in all zones the variable refrigerant volume split system shall be de-energized.

F. Create graphic on ATC system and record, trend, and monitor all information available on the VRV system controller

4.05 ENERGY RECOVERY VENTILATOR

A. General

1. The Energy Recovery Units shall be provided with factory packaged controls as indicated in Division 23 Section, *Heating, Ventilating, and Air Conditioning Equipment*. Refer to Division 23 Section *Heating, Ventilating and Air Conditioning Equipment* for Packaged Controls. Furnish controls as required under this Division to accomplish operation adjustment, and monitoring as required.

2. Duct mounted smoke detectors shall be mounted in the discharge supply duct and exhaust air duct of the unit. Upon detection of products of combustion, the supply air fan, and interlocked exhaust air fan shall shut down and a signal shall be sent to the fire alarm system. Duct detectors shall be furnished under Division 28 and installed under Division 23.

3. ATC subcontractor shall install interlock wiring, humidity sensors, CO2 sensors, thermostats, and control wiring for a complete and operational system.

4. The ATC subcontractor shall install and interlock A/C condensate overflow safety switches to their respective energy recovery ventilators. The condensate overflow safety switches shall be wired to de-energize the energy recovery ventilator in the

case of high level water condition. Field install the A/C condensate overflow safety switches in the cooling coil drain pan. Condensate overflow safety switches shall be U.L. 508 listed.

5. A global outside air carbon dioxide sensor shall be monitored and trended on the ATC system to allow re-set of CO_2 sensor set points based on outside air CO_2 levels.

6. Under this division install and interlock global CO2 detector and space CO2 detectors with ERV.

7. Under this Division, install ERV provided space humidity sensor and interlock with ERV unit for control of humidity and hot gas re-heat.

8. Refer to point list on Contract Drawings for additional monitoring requirements.

9. All items on point list must be monitored on the ATC system.

10. Under this Division install global outside air humidity and temperature sensors and monitor on the ATC system.

11. Under this Division install exhaust air temperature and humidity sensors and monitor on the ATC system.

12. Under this Division monitor the variable frequency drive fan speeds and amperages on the ATC system.

13. Under this Division, install graphics for ERV system and display all points on the ATC system.

14. Under this Division, install current sensors on ERV unit compressors and monitor on the ATC system.

15. Under this Division, install energy recovery wheel rotation sensor and monitor on the ATC system.

16. Under this Division install air flow monitoring station in outside air intake duct and monitor on ATC system.

END OF SECTION

23 30 00
HVAC AIR DISTRIBUTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. This project is to be LEED certified. Refer to Division 01 Sections, including "Sustainable Design Requirements", "Construction Waste Managements", and "Commissioning Requirements" for mandatory work which may apply to all contractors, installers, and suppliers.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 (and Credit MR4.2): For products having recycled content, required documentation for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See Division 01 Sections related to LEED.

2. Product Data for Credit MR 5.1 (and MR 5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See Division 01 Sections related to LEED.

1.02 SUMMARY

A. For General Mechanical Requirements, see Division 23 Section, "Common Work Results for HVAC" and Division 01, "General Requirements".

B. The fabrication and installation of all ductwork, together with related equipment, shall comply with the standards of the National Fire Protection Association, as set forth in NFPA Standard No. 90A, as well as with the requirements of the Sheet Metal and Air Conditioning Contractors' National Association, Inc., and the latest edition of the ASHRAE Guide.

C. All duct sizes shown are net inside clear dimensions. Where internal duct lining is used, increase duct sizes accordingly to provide the indicated net free area. Unless otherwise indicated size runouts, drops, and connections to grilles, registers, diffusers, fans, coils, louvers, filters, and other equipment to the full size of the equipment connection.

D. Minor changes may be made in duct sizes where required to fit the available space, provided the indicated net free area and approximate aspect ratio are maintained.

E. Smoothly transition all ductwork to prevent excessive or unnecessary turbulence or pressure loss.

F. All exposed ductwork in finished areas shall be painted in color as indicated by Architect. All ductwork requiring paint shall be constructed of paint grade galvanized sheet steel with a paintable finish.

1.03 REFERENCES

A. ASTM A 36 - Structural Steel.

B. ASTM A 90 - Weight of coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.

E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

F. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.

J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

K. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

L. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

M. SMACNA - HVAC Air Duct Leakage Test Manual.

N. UL 181 - Factory-Made Air Ducts and Connectors.

O. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

P. NFPA 70 - National Electrical Code.

Q. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE Table of Equivalent Rectangular and Round Ducts.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the projects specified in this

section with minimum five (5) years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum five (5) years experience.

1.06 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA- 90A, and NFPA-90B.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturer.

B. Maintain temperatures during and after installation of duct sealants.

1.08 ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

1.09 LEED REQUIREMENTS

A. Refer to Division 01 Section “LEED Requirements” for description of work under this Division affected by LEED Requirements.

PART 2 PRODUCTS

2.01 DUCTWORK

A. Unless otherwise indicated or specified, fabricate ductwork of galvanized sheet steel, stainless steel, or aluminum conforming to Commercial Designation 3003 Temper H14 and Duct Sheet. Duct gages, jointing and reinforcement shall conform to Tables 4, 5, 6 and 7, as applicable, Chapter I of the latest *ASHRAE Guide and Data Book*. Construction details shall conform to Section I and Section II, as applicable, of *Duct Manual and Sheet Metal Construction for Ventilation and Air Conditioning Systems* as published by Sheet Metal and Air Conditioning Contractors' Association, Inc.

B. Erect sheet metal ductwork in a first-class, workmanlike manner secured in place rigidly and permanently. Provide suitable hangers, securely attached to building construction with bolts, clips or inserts. Hangers shall be structural shapes, flat bars, or formed strap hangers; use of wire will not be permitted. Hangers shall not pass through or be inside duct. Support vertical ducts passing through floors by angles riveted to duct and resting either on floor or on brackets secured to building construction. All space around ducts where they pass through any walls, floors, ceilings, or roofs shall be sealed tight with incombustible inert material. Do not arrange ducts so as to impair the effectiveness of fireproofing around structural members. Provide sheet metal flanged collars around exposed ducts passing through walls, floors, or ceilings to provide finished appearance. Seal all duct joints and seams including supply, return, outside air, combustion air, relief air, ventilation air and exhaust ductwork with *Hardcast* Sealing System as manufactured by Hardcast, Inc., or approved equal.

C. Flexible connections of neoprene or other NFPA approved non-inflammable fabric shall be provided in the duct system at all fan inlet and outlet connections.

D. Provide cut turning vanes in all duct turns where centerline radius is located. Turning vanes shall be air-foil type with extended trailing edges. Fabricate to comply with SMACNA Sheet Metal Construction for Ventilation and Air Conditioning Systems Manual.

E. Provide duct collars and angle iron framework for mounting of automatic dampers.

F. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

G. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

H. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

I. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4-inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

J. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

K. Fasteners: Rivets, bolts, or sheet metal screws.

L. Hanger Rods: ASTM A36 - Galvanized steel; threaded both ends, threaded one end, or continuously threaded.

2.02 DUCT SYSTEMS

A. All supply, return, exhaust, fresh air intake, ventilation, and outside air ductwork shall be constructed for low pressure service (2 inch W.G.).

2.03 DUCT CONSTRUCTION

A. Rectangular and/or Round Ductwork (Low Pressure):

1. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G-90 Zinc coating in conformance with ASTM A90.

2. Make allowance for internal duct lining where required. Sizes shown on the drawings are inside clear dimensions.

3. Determine duct gauges for the longest duct side and use for all four sides. Joints and reinforcing requirements apply to the longest duct side.

4. Reinforce all ducts to prevent buckling, vibration, or noise as recommended in the referenced construction standards, and as required to suit the installed conditions.

5. Do not cross break duct which will receive rigid insulation covering.

6. Where tap sizes of divided-flow fittings are not indicated, make branch and main/connection sizes proportional to their respective air flows and maintain uniform transverse velocities in the fitting.

7. Make radius elbows and radius tee connection with throat radius equal to or greater than the width of the duct. Use vaned elbows where shown and where radius elbows will not fit the space, and in all square bends.

8. Turning vanes shall be the air-foil type with extended trailing edges, 36-inch maximum vane length. Where longer vanes are required, use two or more sets of vanes with intermediate runners securely fastened together.

9. Bolt, screw, rivet, or spot weld reinforcing members securely to the duct on not less than 6-inch centers.

10. Where ducts are open-ended without grilles, registers, or other means of stiffening, reinforce and stiffen the open end with standing seams or an angle frame. Provide rolled edges to prevent any exposed sharp edges.

11. Paint all cut ends on galvanized angles, rods, and other uncoated surfaces with aluminum paint.

12. Where ductwork is not painted or otherwise finished, remove all exposed traces of joint sealers, manufacturer's identification and other markings.

13. Aluminum sheet shall be 3003 H14 alloy or duct sheet, 16,000 psi minimum tensile strength, and capable of being formed to a Pittsburgh lock seam.

14. Reinforcing members for aluminum ductwork shall be galvanized steel or aluminum unless otherwise indicated. Where aluminum reinforcing is used, size the member in accordance with ASHRAE recommendations to have rigidity equivalent to listed mild steel angle sizes.

15. Where aluminum ductwork is used, make allowance for increased thermal expansion. Particularly avoid direct contact between aluminum and concrete or masonry walls subject to dampness.

16. Determine duct gauges per SMACNA based on duct size and pressure indicated.

2.04 AIR VOLUME CONTROLS

A. Furnish and install air volume control devices where indicated and where required to adjust and balance air flow in the systems, whether indicated or not. Volume dampers shall be provided in all branch ducts serving air outlets and inlets.

B. Manual volume dampers in ductwork shall be factory-assembled units with rigid frame, opposed-blade action, and locking quadrant operator. Mark the extended damper shaft and align the operating handle to indicate the blade position. Dampers shall be as manufactured by Ruskin, American Warming and Ventilating, Inc., Arrow, or approved equal. Rectangular dampers shall be Type MD35, with steel channel frame, 16 gauge steel blades, 9 inch maximum blade spacing, low pressure, nylon bearings, galvanized finish with aluminum paint touch up. Round manual balancing dampers shall be Type MDRS25 manufactured by Ruskin, Arrow, American Warming and Ventilating, Inc., or as approved equal. When external insulation is to be applied, provide sheet metal standoffs on all manual volume dampers.

C. Motor-operated dampers shall be as hereinafter specified under Division 23 Section, “Instrumentation and Controls of HVAC & Plumbing System”.

D. Duct turning vanes shall be Tuttle & Bailey *Ducturns*, or approved equal.

E. Furnish and install duct collars and angle iron frames for the installation of ATC dampers.

F. Where volume dampers are installed in exposed finished spaces locate damper handle on top of duct.

2.05 DUCT ACCESS DOORS

A. Furnish and install adequately sized duct access doors at air measuring devices, motor-operated dampers, and duct smoke detectors and other locations where indicated and required for duct access. Doors shall be the continuous piano-hinged type with approved latches and neoprene compression-type gaskets with 1 inch thick fiberglass double skin and shall be Ruskin Model ADH22, Air Balance, Inc., FSA-100 or as approved equal. Stiffen ductwork at door openings. Where doors are installed in insulated ductwork, provide equivalent insulation in the door assembly. Where access doors are installed in the fire-rated partitions, provide *Fire Seal* access doors as manufactured by Air Balance, Inc., or approved equal, UL approved, meeting the rating of the enclosure in which the access door is installed.

B. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

2.06 DUCT LINING (LOW PRESSURE DUCTWORK)

A. All low pressure supply and return ductwork within 10 feet of energy recovery ventilation units and as additionally shown on Contract Drawings, shall be lined on the interior for sound attenuation and thermal insulation.

B. All low pressure ductwork within 10 feet of exhaust air fans and as additionally shown on Contract Drawings shall be lined on the interior for sound attenuation and thermal insulation.

C. All internal duct lining for low pressure duct systems shall be provided with an interior galvanized perforated liner.

D. Provide additional exterior insulation where required and as indicated in Division 23 Section, “HVAC Insulation”.

E. The lining insulation shall be 1 inch thick, 3.0 pcf density, Aeroflex plus Duct Liner Type 300, Owens Corning Quiet R Rotary Duct Liner, Manville, Knauf, or approved equal. The material shall be specifically designed for this application, shall have a black, fire-resistant coating, shall meet NFPA Standards 90A and 90B and shall have a UL Fire Hazard Classification of Flame Spread 25 or less and smoke developed of 10 or less. The black-coated surface shall face the air stream.

F. All exposed edges and the leading edge of all cross joints of the liner shall be coated with the same adhesive used to secure the duct liner to metal surface. All air stream surfaces shall be treated with EPA registered biocide.

G. The duct liner shall be adhered to the metal with 100 percent coverage of adhesive. Adhesive shall conform to Adhesive and Sealant Council Standards for adhesives for duct liner; ASC-A-7001-A-1971.

H. The duct liner shall be additionally secured with mechanical fasteners, which shall compress the duct liner sufficiently to hold it firmly in place. Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1-1971, available from Sheet Metal and Air Conditioning Contractors National Association.

I. All duct lining shall be installed in complete accordance with the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Duct Liner Application Standard, First Edition and Green Guard Indoor Air Quality certification program requirements.

J. Dimensions on drawings indicate inside clear opening of rectangular ductwork. Increase duct dimensions 2 inches each way for accommodating insulation on all shop or field-fabricated rectangular ductwork where lining is specified.

2.07 AIR TERMINAL DEVICES

A. Furnish and install air supply, return, exhaust devices of sizes and capacities as scheduled on the drawings. Catalog numbers shown are Metalaire, Inc., products for equipment which have been found suitable for the application. Products of Tuttle & Bailey, Anemostat, Division of Hart & Cooley, Carnes, Titus, Price, or approved equal will be considered only if performance characteristics including throw, drop, pressure loss, sound pressure level, etc., are equal to or better than the performance characteristics of the specified products. All air devices shall be ADC certified. Ductwork behind registers, grilles and diffusers shall be given two coats of flat black paint. Perimeter of all ceiling diffusers shall be caulked to provide a neat, aesthetic appearance.

B. Device Schedule:

AIR DEVICE SCHEDULE

Device	Accessories	Finish
Supply Diffusers, Lay-in Tile		
Model 5000-A, Rectangular MetalAire Ceiling Diffuser, Throw as Indicated	Integral opposed blade damper	White baked enamel finish
	Removable core	
	Louvered face	
	All aluminum construction	
	Auxiliary panel for lay-in tile installation	
	Adjustable pattern deflector	
Supply Diffuser, Gypboard, Surface Mount		
MetalAire Model 5000-A, Rectangular Ceiling Diffuser, Throw as Indicated (Surface or Duct Mount)	Integral opposed blade damper	White baked enamel finish
	Louver face	
	All aluminum construction	
	Removable core	
	Adjustable pattern deflector	
Exhaust Register, Gypboard, Surface Mount		
MetalAire, Model RHD Rectangular Registers (Surface Mount)	Integral opposed blade damper	Off-white baked enamel finish
	45 degree angled deflecting vanes	
	All aluminum construction	
Return/Exhaust, Transfer Register, Lay-in Tile		
MetalAire, Model RHD Rectangular Registers	Integral opposed blade damper	Off-white baked enamel finish
	45 degree angled deflecting vanes	
	All aluminum construction	
	Auxiliary panel for lay-in tile installation	
	Provide return air filters racks and 1" thick filters where indicated.	

C. Where air terminal devices are installed in duct collars or branches, furnish and install air extractors. Furnish and install control grids, volume dampers, and/or other accessories necessary to ensure uniform air flow across the terminal devices. Accessories shall be of the same material as the terminal device. Install fixed blade terminals so that blades block the normal line of vision. Furnish three (3) of each type of removable key operators.

D. Contractor shall determine frame and mounting type as per type of ceiling as shown on Architectural drawings.

E. Noise Criteria: All air devices shall be sized and selected to limit maximum NC (noise criteria) levels to 30.

2.08 LOUVER BLANK-OFF PANELS

A. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 2 inches (50mm)
2. Metal Facing Sheets: Aluminum sheet, not less than .032 inch (.81mm) nominal thickness.
3. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than .080 inch (2.03mm) nominal thickness with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same finish applied to louvers.
7. Attach blank-off panels with stainless steel sheet metal screws.
8. Cover all unused openings in louvers.

2.09 OPEN END DUCTS (OED)

A. Whether indicated on plans or not, all open-ended ducts shall be provided with a protective screen.

B. All open-ended ducts shall be furnished with a 12 gauge ½ inch x ½ inch aluminum mesh screen. Screens shall be permanently installed in a removable frame, and the frame shall be attached to the open-ended duct in a neat, workmanship-like manner without any exposed edges or sharp surfaces.

C. Screen shall be attached to a ¾ inch x 1/8 inch continuous galvanized perimeter frame. Install duct stiffeners greater than 16 inches in any direction at open-ended ducts.

2.10 DUCT SEALANTS AND ADHESIVES

A. All ductwork shall be sealed, including low pressure exhaust systems. Transverse joints and longitudinal seams in duct systems shall be sealed with a duct sealant of the type

specified hereinafter in Section 1, 2, or 3, or with a tape sealing system as specified in Section 4. Spiral lockseams are not longitudinal seams and do not require duct sealant. All seams and joints shall require duct sealant suitable for the pressure rating and installation application. All sealants shall exceed 500 hours without becoming brittle under ASTM-D572 test conditions (oxygen bomb), unless specified otherwise. No surface preparation or solvent cleaning shall be necessary to remove light coatings of oil and dust before applying sealant unless specified otherwise. Flanged joints shall be sealed according to Section 5. Construction joints that are not fully welded shall be sealed according to Section 6. Adhesive to secure insulation to metal surfaces shall be that specified in Section 7.

1. Assembly joints to be installed indoors shall be sealed with United Duct Sealer or equivalent, which is a solvent-based (polymeric rubber) sealant formulated to withstand temperatures from –29 degrees F to +150 degrees F. Sealant shall have a UL Classification marking with a flame spread of 15 and smoke developed of 0 when applied to inorganic reinforced cement board, both at a coverage of 31 square feet per gallon. Sealant shall exceed 750 hours without becoming brittle under ASTM-D572 test conditions (oxygen bomb).

2. Assembly joints to be installed indoors and outdoors shall be sealed with UNI-WEATHER™ duct sealer or equivalent, which is a solvent-based (Neoprene-phenolic mastic) sealant formulated to withstand temperatures from -20 to +300 degrees Fahrenheit. Sealant shall have a UL Classification marking with a flame spread of 5 and smoke developed of 0 when applied to 18-gauge galvanized steel and a flame spread of 5 and smoke developed of 5 when applied to inorganic reinforced cement board, both at a coverage of 53 square feet per gallon. Sealant shall exceed 1,000 hours under ASTM-D572 test conditions (oxygen bomb) without becoming brittle and 500 hours in QUV accelerated-exterior-aging apparatus without degradation (under ASTM-C732 test conditions).

3. Assembly joints to be installed indoors shall be sealed with UNI-GRIP™ duct sealer or equivalent, which is a water-based (vinyl-acrylic polymer) sealant formulated to withstand temperatures from –25 degrees to +200 degrees Fahrenheit. Surfaces to be sealed should be clean, dry, and free from oil, grease, and dirt. Sealant shall be nonflammable (wet) and fire retardant. Sealant shall have a UL Classification marking with a flame spread of 5 and smoke developed of 5 when applied to 18-gauge galvanized steel and a flame spread of 0 and smoke developed of 0 when applied to inorganic reinforced cement board, both at a coverage of 40 square feet per gallon.

4. Assembly joints shall be sealed with UNI-CAST® tape sealing system or equivalent, which is a combination of an adhesive activator and woven-fiber tape impregnated with a gypsum mineral compound. Modified acrylic/silicone activator (MTA-20 for indoor use) reacts exothermically with the tape to form a hard, airtight seal. Sealant shall be formulated to withstand temperatures from –40 degrees F to +200 degrees Fahrenheit. Combination of tape and MTA-20 adhesive shall have a flame spread and smoke developed of 0. Do not use for outdoors.

5. Flanged joints to be installed indoors shall be sealed with UNI-GASKET™ flange sealer or equivalent, which has a synthetic elastomer base and is

formulated to withstand temperatures from –20 degrees F to +150 degrees F. Sealant shall have a UL Classification marking with a flame spread of 5 and smoke developed of 5 when applied to 18-gauge galvanized steel and a flame spread of 0 and smoke developed of 5 when applied to inorganic reinforced cement board, both at a coverage of 80 square feet per gallon.

6. Where duct fittings are constructed with standing seam or spot-welded techniques, all construction joints shall be sealed with UNI-WELD™ metal cement or equivalent, which is composed of neoprene rubber, resins, and inert reinforcing material dispersed in a petroleum distillate. Sealant shall be formulated to withstand temperatures from –20 degrees F to +225 degrees F. Sealant shall have a UL Classification marking with a flame spread of 0 and smoke developed of 0 when applied to 18-gauge galvanized steel and a flame spread of 0 and smoke developed of 0 when applied to inorganic reinforced cement board, tested as applied in two 1/8 inch beads 8 inches on center.

7. Where insulation is to be secured to metal surfaces, the adhesive used shall be UNI-TACK™ duct liner adhesive or equivalent, which is a water-based, vinyl-acrylic copolymer formulated to withstand temperatures from –20 degrees Fahrenheit to +160 degrees Fahrenheit. Adhesive shall have a UL Classification marking with a flame spread of 0 and smoke developed of 0 when applied to 18-gauge galvanized steel and a flame spread of 0 and smoke developed of 0 when applied to inorganic reinforced cement board, both at a coverage of 267 square feet per gallon.

B. Manufacturers: Duct Mate, United McGill, Semco, Elgen, Childers, Benjamin Foster, or as approved equal.

PART 3 EXECUTION

3.01 DUCT INSTALLATION REQUIREMENTS

A. Coordinate ductwork with other work and install ducts at proper elevations and locations to maintain indicated ceiling heights and clearances. Provide all elbows, transitions, offsets, connections, and other fittings necessary to fit the work into place or to connect to equipment or diffusers. Method of duct support connection to structure and slabs shall be approved by Structural Engineer, and Shop Drawings shall be submitted.

B. Substantially support ductwork with structural shapes, flat bars, or formed strap hangers securely attached to the building structure by means of bolts, clamps, or inserts. Support vertical ducts by angles attached to the duct and resting on the floor or supported by brackets or hangers attached to the building structure. Strap hangers shall be 16-gauge minimum galvanized steel formed under the bottom edge of duct. Use square ¼ inch thick washers tight against the bend on upper strap attachments to horizontal surfaces. Place all supports external to the ductwork and out of the air stream. Provide additional supports at coils and other concentrated loads. Arrange supports so that duct weight is not transmitted to ceilings, fans or other equipment.

C. Prevent direct contact between ductwork and building surfaces or other equipment. Where ducts pass through walls, partitions, floors, ceilings, or roofs, pack and seal the space around the duct with an approved fire-safe inert material. Provide flanged duct

escutcheons at all exposed ducts that pass through walls, partitions, floors, and ceilings.

D. Use galvanized (compatible) corrosion-resistant hangers, supports, brackets, and hardware.

E. Furnish and install NFPA-approved duct connections where shown and at all connections to fans, air handling units, and similar rotating equipment. Use glass-reinforced neoprene fabric, roll-formed to sheet metal strips or flanges. Support adjacent ductwork to provide sufficient slack in the connection.

F. See NFPA 90A, and latest publication of SMACNA. Prevent direct contact between ductwork and building surfaces or other equipment. The opening in the construction around the duct shall not exceed one-inch average clearance on all sides. Where ducts pass through walls, partitions, floors, ceilings, or roofs, pack and seal the space around the duct with an approved fire-safe inert material capable of preventing the passage of flame and hot gases sufficiently to ignite cotton waste when subjected to the same NFPA 251 Time-Temperature Conditions required for fire barrier penetration. All exposed duct penetrations shall be finished with a sheet metal field erected flange escutcheon to form a neat appearance.

G. Coordinate duct installation with the requirements of Division 23 Section, “Vibration Controls for HVAC, Plumbing & Fire Protection Equipment”.

H. Install in accordance with manufacturer’s instructions.

I. Install and seal ducts in accordance with SMACNA *HVAC Duct Construction Standards - Metal and Flexible.*

J. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

K. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

L. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

M. Use crimp joints, with or without bead, for joining round duct sizes eight (8) inches and smaller with crimp in direction of air flow.

N. Use double nuts and lock washers on threaded rod supports.

O. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork systems.

3.02 ACCESSORY INSTALLATION REQUIREMENTS

A. Install accessories in accordance with manufacturer’s instruction, NFPA 90A, and SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, duct detectors, air flow monitoring stations, and elsewhere as indicated. Review locations prior to fabrication.

C. Provide duct test holes where required for testing and balancing purposes. Review locations with Test and Balance Engineer prior to installation.

D. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment and supported by vibration isolators. Refer to Division 23 Section, “Vibration Control for HVAC and Plumbing Systems”.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum duct widths from duct take-off.

F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

G. Install diffusers, registers, and grilles to ductwork with airtight construction.

H. Check location of all air outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangements.

I. Install remote - reading duct dial thermometers in control panels with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length. Mount control panel 60 inches above finished floor and label each dial thermometer.

J. Install duct accessories according to applicable details shown in SMACNA's *HVAC Duct Construction Standards--Metal and Flexible* for metal ducts.

K. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

L. Provide test holes at fan inlet and outlet and elsewhere as indicated.

M. Adjust duct accessories for proper settings.

3.03 DUCT LINING INSTALLATION REQUIREMENTS

A. All portions of duct designated to receive duct liner shall be completely covered with duct liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. The black pigmented or mat faced surface of the duct liner shall face the airstream.

B. Duct liner shall be adhered to the sheet metal. with 90 percent coverage of adhesive complying with requirements of ASTM C916. All exposed leading edges and transverse joints shall be factory coated or coated with adhesive during fabrication. Install perforated galvanized inner liner where indicated

C. Duct liner shall be additionally secured with mechanical fasteners, either weld-secured or impact-driven, which shall compress the duct liner sufficiently to hold it firmly in place. Adhesive bonded pins are not permitted due to long term adhesive aging characteristics. Spacing of mechanical fasteners with respect to duct liner interior width

shall be in accordance with SMACNA HVAC DGS. Maximum spacing for mechanical fasteners shall be as follows:

Velocity = 0 to 2,500 feet per minute (0 to 12.8m/s):

From transverse end of liner	3: (75mm)
Across width of duct	12 inches (300 mm) O.C.
From corners of duct	4 inches (100mm)
Along length of duct	18 inches (450mm) O.C.

Velocity = 2,501 to 5,000 feet per minute (12.8 to 25.4 m/s):

From transverse end of liner	3 inches (75m)
Across width of duct	6 inches (150mm) O.C.
From corners of duct	4 inches (100mm)
Along length of duct	16 inches (400mm) O.C.

D. When air velocities exceed 4,000 fpm (20.3m/s), galvanized sheet metal nosing shall be applied to all leading edges of duct liner.

E. Acoustical Duct Liner shall be cut to assure overlapping and compressed longitudinal corner joints.

F. Upon completion of installation of duct liner and before operation is to commence, visually inspect the system and verify that the duct liner insulation has been correctly installed.

G. Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means of removal of such material.

H. Check the duct system to ensure that there are no air leaks through joints.

3.04 CLEANING

A. Clean duct system and force air at high velocity through ducts to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

C. Ductwork shall be cleaned in accordance with “Duct Cleanliness for New Construction (SMACNA 2000)”, and shall achieve a “Basic” cleanliness level.

3.05 LEAKAGE TESTS

A. All low pressure sheet metal ductwork shall undergo leakage tests at 2 inch W.G. Tests shall be accomplished under this section and witnessed as specified under Division 23 Section, “Testing, Adjusting, and Balancing for HVAC and Plumbing”.

B. Leakage from each duct system shall not exceed 5 percent for low pressure systems and 1 percent for medium pressure systems of the normal air handling capacity of the system.

If the system ductwork is tested in sections, the leakage shall not exceed ½ of 1 percent of the CFM to be handled by that section, and the total leakage of the system shall not exceed 1 percent of the total system CFM. Test pressure shall not exceed the pressure limits of the duct construction as defined in SMACNA *High Pressure Duct Construction Standards*. Repair all leaks which are audible, regardless of the leakage rate of the duct system as a whole, by remaking the entire defective joint or seam. Spot sealing of ducts in place *will not* be acceptable.

C. All duct accessories, including but not limited to volume dampers, ATC sensors, duct detectors, duct coils shall be installed prior to duct leakage testing.

D. Submit a complete report of the ductwork leakage tests to the Architect and include final approved copies in test and balance reports.

3.06 DUCTWORK IDENTIFICATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. All ductwork shall be identified with painted background marked with the name of the service with arrows to indicate flow direction. Color Code and System Identification shall comply with ANSI Standards.

C. Marking shall be plain block letters, stenciled on ductwork (above and below ceilings) and shall be located near each branch connection and at least every ten feet on straight runs of ductwork. Where ductwork is aligned adjacent to each other, markings shall be neatly lined up. All markings shall be located in such a manner as to be easily legible from the floor.

D. Identify ductwork with plastic nameplates or stenciled painting. Identify with air handling unit identification and area served.

E. Length of color field for ductwork shall be 32 inches. Lettering shall be minimum 3-1/2 inches high.

END OF SECTION

SECTION 23 81 26

VARIABLE REFRIGERANT VOLUME SPLIT SYSTEMS WITH HEAT RECOVERY
(AIR COOLED SYSTEMS)

PART 1 GENERAL

1.01. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02. SUMMARY

A. This Section includes Variable Refrigerant Volume Split Systems with Heat Recovery.

B. Related Sections include the following:

1. Division 23 Section *HVAC Piping, Fittings and Valves* for refrigerant piping materials.
2. Division 23 Section *HVAC Insulation* for refrigerant pipe insulation requirements.
3. Division 23 Section, *Vibration Controls for HVAC, Plumbing, & Fire Protection Equipment* for isolation materials.
4. Division 23 Section, *Instrumentation & Controls of HVAC & Plumbing Systems* for temperature-control devices, and control wiring and control devices connected to indoor, outdoor and refrigerant distribution devices.
5. Division 26 Section, *Disconnect Switches & Circuit Breakers* and circuit breakers for field installed disconnect switches.

1.03. DEFINITIONS

A. *EER*: Cooling full load energy efficiency ratio.

B. *IEER*: Cooling integrated (part load) energy efficiency ratio.

C. *High Temperature COP*: Heating coefficient of performance at 42°F.

D. *Low Temperature COP*: Heating coefficient of performance at 17°F.

E. *SCHE*: Simultaneous cooling and heating efficiency.

1.04. SUBMITTALS

A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities of selected model clearly indicated; dimensions; required clearances; shipping, installed, and operating weights; furnished specialties; accessories; and installation and startup instructions.

B. Product data for Variable Refrigerant Volume units specified, including the following:

1. Dimension and plans and elevation drawings including field piping, required clearances and locations of all field connections.
2. Certified fan-sound power ratings.
3. Certified coil-performance rating with system operating conditions indicated.
4. Motor ratings and electrical characteristics plus motor and fan accessories.
5. Filters with performance characteristics.
6. Outdoor air cooled heat pump unit.
7. Summary of all auxiliary utility requirements such as electricity, refrigerant piping, and condensate piping. Summary shall indicate quality and quantity of each required utility.
8. Branch selector box data.
9. Refnet data.
10. ARHI 1230 certification including EER, IEER, high temperature COP, low temperature COP, and SCHE.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail mounting, securing, and flashing of roof curb to roof structure for roof mounted units. Detail mounting and securing to concrete pads for grade mounted systems. Indicate coordinating requirements with roof membrane system or concrete pads and vibration isolation.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

D. Field Test Reports: Indicate results of manufacturer's startup and testing requirements. Submit copies of checklists.

E. Maintenance Data: For equipment to include in the maintenance manuals specified in Division 01.

F. Warranties: Special warranties specified in this Section.

G. LEED Submittal:

1. Product Data for Credit MR4.1 (and Credit MR4.2): For products having recycled content, required documentations for LEED submittal indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content. See specification 018113.

2. Product data for Credit MR5.1 (and Credit MR5.2): For product manufactured, assembled, or extracted within 500 miles of project site, documentation as required for LEED submittal. Include statement indicating costs for each product that is regional. See specification 018113.

1.05. SYSTEM DESCRIPTION

A. Furnish and install where indicated, a variable capacity, heat recovery air conditioning system. System shall be a Variable Refrigerant Volume Series split system as manufactured by Daikin, or approved equal. The system shall consist of multiple indoor units capable of cooling or heating, branch selector boxes, refrigerant joints to separate refrigerant flow between units and headers (refnets), a three pipe refrigeration distribution system using PID control, and an outdoor unit. The indoor units shall be connected to the outdoor units utilizing the specialized piping joints provided by the equipment manufacturer. The outdoor unit shall be direct expansion (DX), air-cooled heat recovery, multi-zone air-conditioning system with fixed speed and variable speed inverter driven compressors using R-410A refrigerant. The outdoor unit may connect to a connected indoor capacity up to 130% of the outdoor unit capacity. All zones are each capable of operating separately with individual temperature control. A dedicated hot gas pipe shall be provided to provide optimum heating operation performance.

B. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously or all of the indoor units associated with one branch cool/heat selector box. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a BMS interface. Provide all interlock wiring between system controllers and building automation system.

C. Branch cool/heat selector boxes shall be located as shown on the drawing. The branch selector boxes shall have the capacity to control cooling and heating down stream of the box. The box shall consist of electronic expansion valves, refrigerant control piping and electronics to facilitate communications between the branch selector box and main processor and between the branch selector box and indoor units. The branch selector box shall control the operational mode of the subordinate indoor units. The use of electronic expansion valves ensures continuous heating during defrost, no heating impact during changeover and reduced sound levels.

D. Manufacturer shall have five years prior experience making similar equipment as described in this specification.

1.06. QUALITY ASSURANCE

A. All equipment and systems shall be tested and certified in accordance with AHRI 1230 (Performance Rates of Variable Refrigerant Flow (VRF) Multi-Split Air Conditioning and Heat Pump Equipment) and bear the AHRI certification seal.

B. Fabricate and label refrigeration system to comply with ASHRAE 15, *Safety Code for Mechanical Refrigeration.*

C. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.
   1. The Terms *Listed and Labeled*: As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A *Nationally Recognized Testing Laboratory* as defined in OSHA Regulation 1910.7.

D. Comply with NFPA 70 for components and installation.

E. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.

F. The system shall be factory tested for safety and function.

G. Coordination: Coordinate layout and installation of indoor units, outdoor units, refrigerant piping, branch selector boxes, refnets, and other appurtenances with piping and ductwork and with other installations.

1.07. DELIVERY, STORAGE, AND HANDLING

A. Deliver outdoor and indoor units as factory assembled units with protective crating and covering.

B. Coordinate delivery of units in sufficient time to allow movement into building or on to roof as indicated.

1.08. WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials or workmanship, within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.

1. Warranty Period: Compressors and Compressor Motor Contactors: Manufacturers standard, but not less than 6 years after date of Substantial Completion.

1.09. ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

PART 2. PRODUCTS

2.01. MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Daikin, Samsung, Sanyo, LG, Mitsubishi, or approved equal.

B. Basis of Design was a Daikin 3-pipe system. All scheduled capacities and efficiencies must be met. Cost of any electrical piping, design, insulation, or other changes associated with other approved manufacturers shall be included in the bid and shall be the responsibility of the Contractor.

2.02. OUTDOOR UNITS – AIR COOLED

A. The outdoor unit is designed specifically for use with variable refrigerant volume system components. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, refrigerant regulator and all components for a complete functioning system.

B. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.

C. The following safety devices shall be included on the outdoor unit; high pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.

D. Unit Cabinet: The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

E. Fan: The unit shall have one or more propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units. The fan shall be a vertical discharge configuration and the motor shall have inherent protection and permanently lubricated bearings and be mounted.

F. Condenser Coil: The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film and pipe plates shall be treated with powdered polyester resin for corrosion prevention.

G. Compressor: Unit shall contain both fixed speed scroll and variable speed inverter scroll compressors. Inverter scroll compressors shall be variable speed (PAM inverter) controlled which shall be capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read and calculated. Each non-inverter compressor shall also be of the hermetically sealed scroll type. With each reading, the compressor capacity (INV frequency or STD ON/OFF) shall be controlled to eliminate deviation from target value. Compressors shall be spring mounted to avoid the transmission of vibration.

2.03. BRANCH SELECTOR BOX

A. Branch selector (BS) boxes shall be located as shown on the drawing. The BS box shall be furnished with 5 electronic expansion valves (EEV's), refrigerant control piping and electronics to facilitate communications between the BS box and main processor and between the BS box and indoor units. The BS box shall control the operational mode of the subordinate indoor units. The use of five EEV's shall control the direction of refrigerant flow and ensure continuous heating during defrost, no heating impact during changeover and reduced sound levels. The branch selector boxes shall be designed specifically for use with heat recovery system components. These selector boxes shall be factory assembled, wired, and piped and shall be run tested at the factory. Unit Cabinet shall have a galvanized steel plate casing. Each cabinet shall house a liquid gas separator and contain a tube in tube heat exchanger. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene. Each circuit shall have at least one branch selector box to facilitate simultaneous heating and cooling in the system. Multiple indoor units may be connected to a branch selector box provided they are within the capacity range of the branch selector. The unit electrical power shall be as scheduled on the Contract Drawings.

2.04. INDOOR UNITS

A. Ceiling Cassette Indoor Unit - The unit shall be completely factory assembled and wired. The casing shall be galvanized sheet with grey heat insulation. This unit shall fit in the ceiling and have the capability of attaching a branch supply duct as well as a fresh air duct. The evaporator fan shall be an assembly with a high performance, fan direct driven by a single motor. The fans shall be statically and dynamically balanced and run on permanently lubricated bearings. The indoor unit shall have an adjustable air outlet system offering 4-way air flow, 3-way air flow, or 2-way air flow. The auto air swing vanes shall automatically swing up and down for uniform air distribution. Return air shall be filtered by a long-life filter to provide approximately, 2500 hours of use in a normal office environment before cleaning. The indoor unit shall be covered with a flat panel which protrudes only 1 inch below the ceiling to provide a neat and clean installation. The coils shall be of nonferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tubes joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan shall extend under the coil and piping. An integral drain pan pump capable of lifting condensate 22 inches shall be provided. An integral booster heater shall not be provided to supplement the unit during the heating mode. The unit electrical power requirements shall be as scheduled on the contract drawings.

2.05. CONTROL SYSTEM

A. The control system shall consist of multiple microprocessors interconnected by a single non-polar two wire multiplex transmission system. Wiring shall be daisy chained from unit to unit direct. NO SPLICES. One microprocessor shall be factory wired and located within each indoor unit. It shall have the capability of sensing return air temperature and indoor coil temperature; receive and process commands from the remote controller. The microprocessor within the wall mounted remote controller shall provide automatic cooling

and heating system changeover; display set point and room temperature; a 24 hour on/off timer so that automatic operation can be set on the timer at one hour intervals from one to twenty-four hours; have self-diagnostic function display; check mode for memory of most recent problem; and provide on-off and system/mode function switching. The heating system shall be controlled so that only warm air is discharged whenever the fan speed exceeds the very low (VLO) speed. Normal operation of the remote controller provides individual system control in which one remote controller and one indoor unit are installed in the same room. The control voltage between the indoor units and the outdoor unit shall be 16 volts D.C. 16 VDC shall be generated from the outdoor unit microprocessor board. The system shall be capable of automatic restart when power is restored after power interruption. System shall include twenty function self diagnostics including total hours of compressor run time. Compressor capacity shall be modulated automatically to maintain a constant suction pressure, while varying the refrigerant volume for the needs of the cooling or heating loads. Indoor units shall use PID control to control superheat.

B. System Controller: Control system shall include a central controller for user interface with system. Controller shall include a Liquid Crystal Display (LCD) touch screen capable of controlling up to 10 outdoor units and 64 indoor unit groups (maximum 128 indoor units).

C. System Controller shall be able to control the following functions:

1. On/Off selection for each indoor unit group or zone that is defined with several indoor unit groups.
2. Setpoint adjustment for each indoor unit group or zone.
3. Fan speed adjustment for each indoor unit group or zone.
4. Heat/cool/fan mode selection for each indoor unit group or zone.
5. Automatic changeover and antifreeze/overheat protection.
6. Forced shutdown terminals.
7. Priority settings for restriction of local access for start/stop, heat/cool mode and setpoint adjustment (at local remote controllers).
8. Setpoint limitation in both heating and cooling mode.
9. Weekly schedule with start-up and shut off times, temperature settings, and operation modes; 16 operations/each day can be set in one schedule, and 8 different schedules are available for special working days, holidays, or period of non-use.
10. Actual time display and setting.
11. Reset ability for malfunction codes and filter maintenance warning.
12. Maximum 13 months back up power supply to maintain the memory.
13. Non systems units (e.g. energy recovery ventilator) can be started/stopped and general alarm/status reported using Digital Input or Digital Input/Output units, including interlock program.
14. Controller must be BACnet compatible.

D. Controller shall provide control transformer for 24 VAC supply voltage for controllers as required.

E. Provide interface devices as required to interface to Building Automation System. ATC Interface shall allow monitoring of all points indicated on the point list.

F. Furnish the controls with the necessary interfaces to communicate via BACnet/IP or LonWorks to a building automation system.

G. All inputs and outputs on the manufacturer's controller shall be viewable via the interface.

H. All set points and schedules shall be editable via the interface by the building automation system.

I. In addition to standard inputs/outputs provide additional input/outputs as required to accomplish sequence of operation and items listed on point list.

J. The manufacturer shall be responsible for assisting and participating in the integration of the equipment into the building automation system and shall provide programming, testing, verification, and on site personnel as required.

PART 3. EXECUTION

3.01. EXAMINATION

A. Examine space for compliance with requirements for conditions affecting installation and performance of swimming pool dehumidification units. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02. INSTALLATION

A. Mount indoor and outdoor units as detailed on contract drawings and according to manufacturer's written instructions.

B. Install all interlock and control wiring between indoor units, outdoor units thermostats, and condensate pumps.

C. Supply initial charge of refrigerant and oil as required.

D. Install indoor ceiling cassette on vibration isolators.

E. Install outdoor units on concrete pads or on roof curbs as indicated on drawings.

F. Comb out fins on heat pump unit where deformed or bent. Replace or repair broken fins.

G. Install condensate lift pumps, float switches, alarm, unit shut down wiring and detection block units per manufacturer's recommendations.

H. Install system controller and interlock all indoor and outdoor units.

I. Install lockable caps on all outdoor unit refrigerant service valves to prevent tampering.

3.03. CONNECTIONS

A. Drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. High/low pressure gas line, liquid and suction lines must be individually insulated between the outdoor and indoor units.
2. Refrigerant Piping: conform to applicable requirements of Division 23 Section, *HVAC Piping, Fittings, and Valves*. Connect to supply and return coil tappings with shutoff valve and union or flange at each connection.
3. Install refrigerant piping, refnets, Branch selector boxes, insulation, and control wiring as required by the manufacturer.
4. Install isolation valves on all three pipes between outdoor unit and branch selector boxes.
5. Install isolation valves on both pipes at every indoor unit.

B. Electrical: Conform to applicable requirements in Division 26 Sections.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04. COMMISSIONING AND MANUFACTURER'S FIELD SERVICES

A. Verify that installation is as indicated and specified. Provide factory authorized start-up and training.

B. Complete manufacturer's installation and startup checks and perform the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, air-cooled condenser coil, and fans.
3. Verify that clearances have been provided for servicing.
4. Check that labels are clearly visible.
5. Clean condenser and inspect for construction debris.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Adjust vibration isolators.
9. Verify all piping and branch selector boxes are insulated.

C. Start unit according to manufacturer's written instructions.

1. Complete startup sheets and attach copy with Contractor's startup report.
2. Start-up units in close coordination with testing/balancing.

D. Check and record performance of interlocks and protection devices; verify sequences.

E. Operate unit for an initial period as recommended or required by manufacturer.

F. Calibrate thermostats and humidity sensors.

G. Check internal isolators.

H. Start refrigeration and measure and record the following:

1. Coil leaving-air, dry- and wet-bulb temperatures.
2. Coil entering-air, dry- and wet-bulb temperatures.
3. Refrigerant suction/discharge pressures.
4. Indoor and outdoor unit amperage, voltage, and watts.
5. Fan Rotation and RPM.

3.05. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Review data in the maintenance manuals. Refer to Division 01 Section, *Contract Closeout*.
2. Review data in the maintenance manuals. Refer to Division 01 Section, *Operation and Maintenance Data.*
3. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

C. Contractor shall perform commissioning tasks which include testing, start-up and adjustments where required per the specifications, local code and manufacturer's instructions. As such commissioning pre-functional and functional test sheets will not be provided by the commissioning agent. The commissioning agent shall witness and review a sample of the specified testing, startup and adjustments. Contractor shall provide the commissioning agent with a copy of any reports associated with specified testing, startup and adjustments.

1.2 REFERENCES

A. Reference Section 230513 for all motors being furnished and/or provided by the Electrical Contractor.

1.3 INSTRUCTIONS AND GENERAL REQUIREMENTS

A. The word "Owner" shall mean Capital School District or their representative on this Project.

B. The word "Contractor" shall mean the Contractors responsible for the Mechanical, Plumbing, Fire Protection and Electrical Work and who shall perform the work as described herein and indicated on the drawing with respect to the trade.

C. The word "Design Professional" or "The Design Professional" shall mean the Architect and/or Engineer.

D. The term "Furnish": shall mean to obtain and supply to the job site. The term "install" shall generally mean to fix in position and connect for use. Where language indicates that one party or trade is to "install" and another is to "connect", the term "install" shall mean only to fix in position, and "connect" shall mean to make final connections to. The term "Provide" shall mean to furnish and install.

E. It is the intent and purpose of these specifications and accompanying drawings to cover and include each item, all materials, machinery, apparatus, and labor necessary to properly install, equip, adjust, and put into perfect operation the respective portions of the installations specified and to so interconnect the various items or sections of the work as to form a complete and properly operating whole.

F. Any equipment, apparatus, machinery, material and small items not mentioned in detail, and labor not hereinafter specifically mentioned, which may be found necessary to complete or perfect any portion of installation in a substantial manner, and in compliance with the requirements stated, implied or intended in these specifications shall be furnished without extra cost. This shall include all materials, devices or methods peculiar to the machinery, equipment, apparatus, or systems furnished and installed as part of the Electrical work

G. Drawings and specifications have been prepared with best knowledge of conditions available at the time of design. If any obscurities or discrepancies exist, they shall be brought to the attention of the Design Professional before bids are submitted. If they are not discovered before bids are submitted, the Design Professional shall be notified and shall render decision. This decision shall be final.

1. Drawings and Specifications are intended to be complementary; items described or shown in one but not both are to be furnished as if fully shown or described in both locations.

H. The Contractor shall carefully examine all drawings, specifications and contract documents, and the site before submitting his proposal for this work. The Contractor shall compare the site with drawings, specifications and contract documents for all other branches of the work. He shall include in his proposal any monetary sums which he may deem necessary to cover the difficulties and/or costs for furnishing and installing complete all of the work shown on the drawings, the specifications and/or implied therein.

I. It is the intent of the Contract Documents to describe a functionally complete Project to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.

J. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents.

K. Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to The Design Professional any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from The Design Professional before proceeding with any Work affected thereby.

L. If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, Contractor shall promptly report it to The Design Professional in writing.

M. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and The Design Professional, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of The Design Professionals, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible, or by Owner.

N. The Design Professional will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to The Design Professional in writing within 30 days of the event giving rise to the question

O. The Design Professional will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

P. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish The Design Professional the required certificates of inspection or approval.

Q. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and The Design Professional's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and The Design Professional.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall, before submitting his proposal, visit the site of the work and acquaint himself with all conditions relevant to the work and its surroundings. The Contractor shall carefully investigate to determine any variances between actual conditions at site as shown or represented in the specifications or drawings. Anything in the contract documents or any representations, statements, or information made or furnished by The Design Professional notwithstanding, the Contractor shall, regardless of any such conditions relevant to the work, the site of work or its surroundings, assume full and complete responsibility thereof, and all risk in connection therewith at no additional cost to the Owner.

B. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

C. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and The Design Professional except under extraordinary circumstances. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

D. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

E. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by The Design Professional, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

F. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

1.5 CODES, RULES, PERMITS, FEES, AND STANDARDS

A. All work described in this specification shall be done in accordance with any applicable Federal, State and Local Codes, Laws, Ordinances, Rules and Regulations governing work of this type.

B. The Contractor shall give all necessary notices, obtain all permits and pay all governmental taxes, fees, deposits and other costs in connection with his work. He shall file all necessary plans, prepare all documents and obtain all required Certificates of Inspection and Approval for his work, including those for occupancy, and deliver same to The Design Professional before request for acceptance and final payment for the work.

C. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings, in addition to Contract Drawings and Documents in order to comply with all applicable Codes, Laws, Ordinances, Rules and Regulations, whether or not shown on Drawings and/or Specifications.

D. Nothing stated or shown in the Contract Specifications and Drawings is intended to conflict with the above regulations. Should the Contractor find any apparent conflict, it shall be his responsibility to notify the Architect before any work in question is performed or materials purchased.

E. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of The Design Professionals, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work.

F. All materials furnished and all work installed shall comply with the following rules, codes, and standards:

National Electric Code – 2008
All applicable State and Local Codes (ICC 2009) as amended and adopted by the City of Dover.
City of Dover – Public Utilities Department – Electrical.
State of Delaware DTI – Structured Cabling System – Standards and Specifications for Public School; latest edition.
Capital School District Design Standards.
Lighting Power Densities to meet IECC 2009 requirements.
IESNA standard RP-3 and RP-6.
Delaware State Fire Prevention Regulations – 2009
International Fire Code – 2009
NFPA Life Safety Code – 2009
ANSI A117.1-03 - 2003

Recommendations of the Fire Insurance Rating Organization having jurisdiction.
Requirements of all government departments and agencies having jurisdiction.

G. All package equipment shall be independently third party labeled as a system for its intended use by a nationally recognized testing laboratory in accordance with OSHA 29CFR 1910, NEC, and NFPA.

1.6 ABBREVIATIONS

A. The following is a description of the abbreviations used herein:

AC	Alternating Current
ACRMA	Air conditioning & Refrigerating Machinery Assoc., Inc.
AIEE	American Institute of Electrical Engineers
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASA	American Standards Association
ASTM	American Society of Testing Materials
AWG	American Wire Gauge Size
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NFC	National Fire Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association

OSHA	Occupational Safety and Health Association
U.L.	Underwriters' Laboratories, Inc.
IBC	International Building Code
IMC	International Mechanical Code
IFC	International Fire Code

B. Refer to the drawings for other symbols and abbreviations.

1.7 WORKMANSHIP

A. All work under this Contract shall be properly coordinated with the work of all trades and separate Contractors with which it comes in contact.

B. All work under this Contract shall be installed in a first-class, neat and workmanlike manner satisfactory to The Design Professional by experienced and skilled mechanics of the trade involved.

1.8 OPERATING INSTRUCTIONS

A. Provide to the Owner three bound copies of compete written instruction on the operation, care and maintenance of each piece of equipment and the installation as a whole. Include frequency of inspection, cleaning and adjusting and other attention as may be required in accordance with manufacturer's instructions. Material shall be manufacturer's brochures, catalog cuts, parts lists, wiring diagrams, etc. Also supply Owner's with three complete sets of approved shop drawings.

B. Furnish qualified personnel to instruct the Owner's personnel in the maintenance and operation of all equipment and systems. Instructing personnel shall remain on the job continuously during working hours until such instruction is complete, but not less than 40 hours.

C. A video recording in digital format (DVD) of the operator training session shall be made during this training period and the DVD submitted to the Owner with the operation and maintenance manuals.

1.9 CORRECTION OF WORK AFTER FINAL PAYMENT AND GUARANTEE

A. Comply as applicable with Section 01 20 00 – Price and Payment Procedures.

B. Final payment shall not relieve the Contractor of responsibility for faulty equipment, materials and workmanship and unless otherwise specified he shall remedy any defects due thereto and pay for damage to other work resulting therefore, which shall appear within a period of one (1) year from the date of acceptance.

C. Include guarantees by the respective equipment manufacturers which shall be subject to the terms and time limits defined under this section.

D. Guarantees furnished by Subcontractor and/or equipment manufacturers shall be counter-signed by the related Prime Contractor for joint and/or individual responsibility for subject item.

E. Manufacturer's equipment guarantees or warranties extending beyond the guarantee period described herein shall be transferred to the Owner along with the Contractor's guarantees.

1.10 SUPERINTENDENCE

A. The Contractor shall give his personal superintendence to the work or shall have a competent superintendent, satisfactory to The Design Professional, and the Owner, present at all times during construction with authority to act for him. The Contractor shall also provide an adequate staff for the proper installation, coordination and expediting of his work.

1.11 SCAFFOLDING, RIGGING, HOISTING

A. The Contractor shall furnish all scaffolding, staging, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished or installed by him and shall remove same from premises when no longer required.

B. Scaffolding and staging construction and maintenance shall be in strict accordance with all applicable codes and regulations including Contractor's safety regulations. The structure shall be erected so as not to interfere with the work of others. If it becomes necessary to move the scaffolding and/or staging to permit installation of other work, the Contractor shall do so at his own expense.

C. Scaffolding, staging and hoisting equipment shall not be supported from piping, conduits or other equipment.

1.12 ROOF PROTECTION

A. Provide adequate roof protection during the construction phase and remove same after the work is completed. Any damage to the roof surface will be repaired at the expense of the Contractor.

1.13 SUPPORT STEEL AND MISCELLANEOUS WORK

A. The Contractor shall provide all necessary miscellaneous steel required for the installation and support of the work under this contract. Work shall include but not be limited to conduit supports, equipment supports, gratings, handrails, transformers, etc. Perform all rigging required to set the equipment in place.

B. Unless otherwise indicated, all structural steel shall be ASTM-A36 with hot dipped galvanized finish. Welds shall be finished with (2) coats of zinc rich paint.

1.14 AS-BUILT DRAWINGS

A. The Contractor shall keep on the job a separate set of drawings on which he shall make a record of any changes in location, size or other details or installation not covered by supplemental or detail drawings. Such records shall be made at the time the changes in the work are made so that at any time the marked drawings indicate the true condition of the work. He shall record the exact dimensioned locations, grades, elevations and sizes of all underground and under floor slab conduit and piping. Dimensions shall be distance from columns, finished building surfaces, curbs and finished grade lines. At the completion of the work the marked drawings shall be transferred

to AutoCAD 2005 (or later) drawings and the drawing files shall be forwarded to The Design Professional.

1.15 PAINTING

A. Generally all painting shall be performed by this Contractor unless otherwise indicated.

B. The Electrical Contractor shall be responsible for painting all color coded junction boxes.

1.16 GUARANTEE

A. All equipment and components of all systems furnished under this Contract shall be guaranteed to perform trouble free for a period of one year from the date of final acceptance of installation by The Design Professional. Any equipment that has been in operation prior to the date of acceptance shall also be guaranteed to be free of defects and perform without failures for a period of one year after the date of final acceptance. Any corrections and adjustments to the systems, replacement of equipment or parts during the guarantee period shall be furnished by the Contractor, at no additional cost to Owner.

B. During the one (1) year guaranty period the Contractor shall make a minimum of two (2) visits to the site (6 months after acceptance and immediately prior to the end of the guarantee period). During each visit, the Contractor shall thoroughly check all equipment for proper operation. Reports shall be generated and forwarded to the Owner describing the systems inspected, date of inspection, and status of equipment.

1.17 SCHEDULING OF WORK

A. The scheduling of any work affecting existing installations or facilities, shall be coordinated with the Owners' representative. Shut-down of utilities or equipment affecting operations of any existing part of the building will not be permitted except as provided below. Any premium time or additional cost to comply shall be at the expense of the Contractor and considered to be included in his bid. Shut-down of any operating facility or services including plumbing, fire protection, refrigeration, heating, air conditioning, electrical, or other installations shall be preceded by a written request at least seven calendar days prior to the shut-down.

B. All required shut-downs unless otherwise instructed, shall be during nights, holidays, or on weekends. Any tests which are to be carried out on the building facilities and any connections to be made in the building facility which would involve a change in the system or liability to the system or involve a shut-down in light or power, the Contractor shall not proceed with such operations until he has received written permission from the Owner.

C. Other Contractors will be performing work in the complex simultaneously while this Contractor is engaged to do work. The Contractor, in addition to coordinating with the Owner, shall coordinate and schedule shutdown of utilities, fire alarm, or equipment with the other Contractors. Should the failure of this Contractor to coordinate or notify the other Contractors of the shutdown of utilities cause a monetary burden on the other Contractors, this Contractor shall compensate the other Contractor’s for their reasonable monetary loss.

1.18 CONCURRENT WORK BY THE OWNER

A. The Owner reserves the right to have other Contractors perform work in other areas of the Complex simultaneously while this Contractor is engaged to do work. This Contractor and his personnel shall cooperate and coordinate the work to be performed with all other Contractors with who he comes in contact. In no way shall this Contractor interfere with the progress of the work.

1.19 CONSTRUCTION ELECTRICITY

A. Electrical power for lighting and operation of construction power tools by all trades shall be provided by Contractor from local utility or Contractor's on site generator. Contractor shall provide all safety devices, extension cords, and remote outlets as required by regulations and use. All construction electric power shall be GFCI protected.

B. Temporary lighting and wiring shall be provided by the Contractor as required by OSHA and be removed upon finishing the work.

PART 2 MATERIALS AND EQUIPMENT

2.1 GENERAL

A. All installed materials and equipment shall be new and the best of their kind and shall conform to the grade, quality and standards specified herein in every detail.

B. Unless otherwise specifically stated, all materials and equipment offered under these specifications shall be limited to products regularly produced and recommended by the manufacturer for the service intended. This material and equipment shall have capacities and ratings sufficient to amply meet the requirements of the project. The capacities and ratings shall be in accord with the Design Professional’s data or other comprehensive literature made available to the public by the manufacturer and in effect at the time of opening bids.

C. Equipment shall be installed in accordance with manufacturer’s instructions for type and quality of each piece of equipment used. These instructions shall be obtained from the manufacturer and shall be considered part of these specifications. Type, capacity and application of equipment shall be guaranteed suitable to operate satisfactory. No experimental material or equipment shall be permitted.

D. All equipment, material and devices for which a label service is available shall bear the label of the Underwriters Laboratory, Inc. (UL).

2.2 EXCAVATION AND BACKFILL

A. Perform all excavating and backfill necessary for work under this Contract. Comply as required with Division 31 – Earthwork. It is assumed that all excavation under this Contract will be soil excavation. In event that rock is encountered, the Contractor shall be compensated for rock excavation in accordance with the unit prices or soil and rock excavation. Bidder shall state in his proposal, the unit prices for soil and rock excavation and the unit prices for soil excavation to be omitted. Rock excavation shall consist of solid rock or boulders over two cubic yards in volume

or other material which can only be removed by line drilling or chipping by power equipment; blasting will not be permitted. In event rock is encountered notify the Design Professional of its existence in the areas not to be excavated and accurate measurements of the extent of the rock actually removed shall be made and submitted to the Design Professional.

B. To protect persons from injury, and to avoid property damage, adequate barricade, construction signs, torches, lanterns, and guards shall be placed and maintained during the progress of the construction work and unit it is safe for traffic use. Rules and regulations of local authorities respecting safety provisions shall be observed.

C. The excavation may be accomplished by machine to within 2 inches of the subgrade elevation. The excavation shall be completed by hand to neat lines.

D. Trenches shall be instrument graded using batter board and flow line and of sufficient width to provide a free working space of not less than 24 in. width and not greater than 12 in. on each side of the conduit, whichever is greater. Trenches shall also be wide enough to thoroughly ram the backfilling around the conduit and to secure a firm bed.

E. In earth excavation, the trench shall be carried to the invert of the conduit. Where rock excavation is encountered, the trench shall be carried to a point 6 in. below the construction. No construction shall be bedded directly upon rock, but shall be cushioned by a 6 in. layer of selected crushed stone or gravel.

F. Where material is removed below the grade of the bottom of a structure it shall be replaced with concrete of the same quality as the concrete in the structure. Where material is removed below the grade of a conduit trench it shall be replaced with a lean concrete mix. Make no excavation to depth below a line of slope one ft. rise on 2 ft. length from such excavation to bottom of footing on other construction.

G. Any conduit that is run in unstable ground shall be supported on 5'-0" centers with concrete or brick piers. These piers shall be not less than 12 inches square and must reset on solid ground. Brick piers shall be laid in cement mortar.

H. Maintain banks at all times by means of shoring and bracing to avoid cave-in and make good any damage done to property or work of others due to failure to properly shore any excavation. Shoring done shall be removed after installation and test of systems have been approved. Material for shoring shall be placed in accordance with the regulations of the Department of Labor and Industry.

I. All excavations shall be left open until reviewed by the Design Professional. After the work has been installed, tested, inspected, the excavation shall be backfilled with the best carefully selected materials free from stones, large pebbles, hard lumps on frozen earth. Trenches shall not be backfilled until the work has been reviewed by the Design Professional. All backfill shall be made in 8 in. layers. The first 2 layers shall be fine earth, hand-tamped. The remainder of the fill over new construction to the surface shall be ordinary approved excavated material placed in 8 in. layers and thoroughly compacted to not less than 90% of maximum Modified Density as determined by ASTM D 1557-70. No water soaking will be permitted. All excess materials shall be disposed of as directed. Seeding shall be by the General Contractor.

J. Where excavation is required under existing walkways and roadways, surface shall be restored with new materials equivalent to the material originally used. Whole cement pavement blocks shall be removed and replaced; removal and repair of partial blocks is not permitted.

2.3 PUMPING

A. Provide pumping equipment to pump all water to prevent it from collecting in trenches, basement areas, and any other excavations necessary to carry out contract requirements. Prepare run-off trenches as required to pump water into and use surplus earth to form dam at top of excavation to run back surface water.

B. Comply as applicable with Section 31 21 19 – Dewatering.

2.4 CHASES AND OPENINGS

A. Provide information to the appropriate trades regarding size and location of all openings and chases as required for the installation of this electrical Work.

2.5 CUTTING AND PATCHING

A. Provide all cutting and patching required for work performed under this Contract. Comply as applicable with Division 09 – Finishes. No holes may be cut or drilled in structural members without prior approval of Owner's Representative. Cutting shall be done by mechanics skilled in their respective trades.

B. No cutting that may impair the strength of the building construction shall be done. No holes may be drilled in or attachments welded to the beams or other structural members without prior approval from the Owner's Representative. All work shall be done by mechanics skilled in their trade.

C. All patching shall be done in a manner to match appearances and quality of existing surfaces.

D. Provide sleeves for conduits, raceways, and cables passing through poured concrete decks, footings, walls, etc. Cut all openings for conduit passing through precast concrete or existing concrete masonry. Such holes shall be cut with core drill or similar equipment. They shall not be cut with hammer or chisel, or with any power tool depending on impact for its cutting power.

E. For holes and openings in pre-cast concrete, 2-1/2 inch round and above, or 2-1/2 inch and above on longest side, prepare a drawing for the Design Professional's review for same to be pre-cast in the factory; for holes and openings smaller than above, prepare a drawing for the Design Professional's review for same to be cut, cored or drilled in the electrical trade.

F. All cutting and patching shall be performed by the Contractor. All holes shall be core bored. All floors, blacktop, walks, curbs, etc. shall be saw cut.

G. The Contractor shall prepare required openings fir ductwork, piping, conduit, and all other work required for the installation of the equipment and systems installed.

H. Unless otherwise indicated, the Contractor shall patch and seal all walls, floors, ceilings (drywall, plaster, lay-in, etc.) soffits, etc. where existing items such as conduit, raceways, hangers, supports, etc. Are removed or new work is installed under this contract. All patching shall be performed with equivalent materials and finishes and shall match adjoining surfaces in both texture and finish.

I. Remove and replace existing ceiling system tiles and grids as required to install the new work. Repair as necessary and use new grids and tiles to match the existing.

J. The contractor shall properly set all sleeves required for his work described under this section during construction.

K. Where sleeves and openings are not installed or are incorrectly sized or located as a result of Contractor's failure to furnish verifying drawings or set sleeves in sufficient time so as not to delay construction, all cutting and patching shall be done by the respective Contractor in a manner of satisfactory to the Design Professional and all costs are borne by the Contractor.

N. Conceal conduit in all finished locations. Cut and patch existing ceilings, walls, and structural members where necessary for concealment.

2.6 CONCRETE

A. Provide concrete work required for work performed under this Contract. Comply as applicable to Division 03 – Concrete.

B. Concrete shall have a minimum of 28-day compressive strength of 4000 lbs. per square inch. Forms shall be lined with tempered hard board, properly braced so that finished surfaces are smooth and true to line dimension. Corners shall be chamfered 1-inch. Foundation bolts shall be built into the concrete and where depth permits and shall be set in iron pipe sleeves for adjustability. The Contractor shall furnish all required foundation bolts, washers, sleeves, plates, templates, etc., for all mechanical and electrical equipment. Conduits for pad mounted motors shall be installed within the pad area. The Contractor shall coordinate with the Electrical work and shall size equipment pads accordingly to receive electrical conduit.

C. Placing of reinforcing steel and concrete shall be done according to the recommendations of the American Concrete Institute and Concrete Reinforcing Steel Institute, and all materials shall conform to American Society for Testing Materials Specifications, applicable to this work. Equipment pads shall be properly dowelled in with floor construction, and shall have sloped bevels on all horizontal and vertical edges.

D. Form work shall be of sufficient strength to maintain desired shape during pouring of concrete and tight enough to prevent leakage of the grout through joints.

E. Submit shop drawings for approval showing dimensions, reinforcing and dowelling.

F. Provide at the time of pouring concrete, all necessary anchor bolts. Anchor bolts shall be the hook type, of proper size and length to suit the equipment. Anchor bolts shall be set in pipe sleeves of approximately twice the bolt diameter and one half the embedded length of the bolt. Assume full responsibility for proper emplacement of the bolts.

G. Drop-in wedge anchor bolts or self-drilling anchors may be used in place of hook bolts. Minimum embedment in concrete of wedge anchor bolts shall be in accordance with manufacturer's instructions. Wedge anchor bolts shall be manufacturer by Phillips Drill Co. or USM Corp. Self-drilling anchors shall be manufactured by Phillips Drill Co.

H. After equipment is set in place and bolted down, any space between equipment base and floor slab or foundation shall be completely filled with non-shrink grout equal to Master Builders Co., Ltd. Embeco 153 grout.

I. Provide reinforced concrete pads under all mechanical, plumbing, fire protection, and electrical equipment.

J. Concrete pads under equipment unless otherwise indicated shall be a minimum of 4” height, six inches beyond equipment on all sides, and in all cases not less than what is indicated on drawings. Concrete pads shall be reinforced with 4” x 4” wire mesh, No. 6 gauge. Concrete pads shall be properly bonded and dowelled to the floor slabs.

2.7 DEVICE BOXES

A. Provide for each device indicated, a box suited to the purpose for which the device is to be put and to the location in which it occurs.

B. Concealed device boxes shall be pressed steel, not less than 4" square, and 1½" deep, zinc-coated and provided with the proper size knockouts for the conduits to be used. All unused knockouts shall remain closed. Boxes in concrete slabs shall not be less than 2" deep. Boxes in finished plaster surfaces shall be provided with suitable approved plaster covers. Cast boxes with threaded hubs shall be used for all surface mounted switches, receptacles, etc. Use minimum 2½” deep masonry box for 4” block and minimum 3½” deep masonry box for 6” and 8” block.

C. Do not install device boxes back to back.

D. Coordinate with Design Professional prior to installation for all device mounting heights.

E. Secure electrical devices firmly in place within boxes, setting devices straight and true with box sides and mounting surface.

F. Install face plate straight and true with mounting surface.

1. Gaps between back of plate and mounting surface are not permitted.

2. Set face plate mounting screws with slots in vertical direction.

G. All backboxes recessed in concrete or CMU masonry walls shall sit flush with face of wall. Provide boxes with proper depth and/or extension ring.

H. Wiring devices to be furnished and installed by this Contractor shall consist of the various types of wall switches, receptacles, outlets, and plates as required for the Electrical Work. The extent of the wiring devices shall be shown on the drawings.

I. Local wall switches near doors shall be located on the strike side of doors as finally hung, whether or not so indicated on the Plans. If, because of the construction, it is not practical to mount on the strike side, these locations shall be brought to the Design Professional's attention, and meet his approval before roughing in.

J. Single pole switches shall switch the ungrounded wire of circuits. Neutral wire shall not run through switches provided with a neutral shunt or bridge.

K. Switches shall be mounted with the long dimensions vertical.

L. For each voice, data, voice/data, CATV, and audio outlet shown, provide a 4" square by 2-1/8" deep box with conduit and pull wire turned out above an accessible ceiling space unless otherwise noted.

M. All receptacles and communication outlets located next to each other shall be mounted 8" apart (horizontally) center to center.

N. All communication outlets located adjacent to each other shall be ganged under single cover plate.

O. All switches located adjacent to each other shall be ganged under single multi-gang cover plate.

2.8 JUNCTION AND PULLBOXES

A. Provide junction and pullboxes in conduit and EMT runs as shown or as required. These shall be of code gauge galvanized steel, riveted or welded construction, reinforced as necessary for rigidity during and after installation, and with proper flanges to receive the covers, unless otherwise indicated.

B. Boxes shall be not less than sizes required by Article 314 of National Electrical Code or as shown on Drawings, and large enough to accommodate wiring without sharp bends in conductors or excessive bearing of wires against covers.

C. In vertical runs of conduit provide a NEC sized junction box with cable support bushing and insulating wedges spaced not greater than the values given in NFPA 70 Table 300-19 (a) unless otherwise noted. If wedges do not adequately support cable, in addition, provide cable clamps.

D. Rigid conduit connections shall be secured in place by double locknuts and insulated bushings.

2.9 HANGERS AND SUPPORTS

A. Reference Section 260529 for additional requirements.

B. Runs of exposed conduit and EMT shall be supported from approved individual pipe hangers spaced in accordance with the National Electric Code. Hangers shall be approved as electrical raceway support devices. Caddy fasteners will not be accepted.

C. Hanger rods shall be supported from approved malleable iron inserts, imbedded in the concrete floor slabs at the time the floor slabs are poured, approved anchor at attachment C-type malleable iron clamps, or from unistrut support system.

D. All materials and equipment installed by the CONTRACTOR shall be firmly supported and secured by the construction. Where necessary, anchors shall be non-hydrophobic and shall be inserted in holes drilled in the construction in accordance with the manufacturer's instructions.

E. Raceways, boxes, etc. shall be supported directly from structure, independent of ceiling grid system, duct, piping or other work. Provide unistrut framing, as required, to clear interferences from the other trades,

F. Conduits and EMT shall be securely and independently supported so that strain will not be transmitted to outlet box and pullbox supports, etc. Supports shall be rigid enough to prevent distortion of conduits during wire pulling.

2.10 WIRING DEVICES

A. Wall Switches

1. Switches for the local control of lighting shall be of the extra heavy duty specification grade, quiet toggle type.

B. Receptacles

1. Receptacles for convenience outlets shall be extra heavy duty specification grade grounding duplex, parallel slot, self-aligning type.

C. Special Purpose Outlets

1. Where shown on the drawings, provide special purpose extra heavy duty specification grade outlets of the ampere capacity, voltage, and NEMA configuration indicated.

D. Wall Plates

1. Unless otherwise specified, all wall plates for switch, receptacle, and similar outlets shall be brushed stainless steel with beveled edges to lie flat against the wall. Where more than one switch or outlet occurs at one point, gang plates shall be used.

2. Weatherproof receptacles shall have horizontal metal weather protective covers equal to Mulberry #30451Z (bronze). Provide weatherproof “While-In-Use” covers where indicated and for all sump sumps.

3. Weatherproof switches shall have cast metal lever type cover plates.

E. All devices shall be recessed, unless otherwise noted. Contractor shall cut and patch existing structure to recess all devices, conduit, and wiring in finished areas.

2.11 ELECTRICAL IDENTIFICATION PRODUCTS

A. Adhesive Marking Labels for Raceway and Metal-clad Cable: Pre-printed, flexible, self-adhesive labels with legend indicating voltage and service (Emergency, Lighting, Power, Light, Power D.C., Air Conditioning, Communications, Control, Fire).

1. Label Size: As follows:

a. Raceways 1-inch and smaller: 1-1/8 inches high by 4 inches long.

b. Raceways larger than 1-inch: 1-1/8 inches by 8 inches long.

2. Color: Black legend on orange background.

B. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

C. Plasticized Card Stock Tags: Vinyl cloth with preprinted and field-printed legends to suit the application. Orange background, except as otherwise indicated, with Eyelet for fastener.

D. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners.

E. Baked-Enamel Warning and Caution Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.

F. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, preprinted cellulose acetate butyrate signs with 20-gauge, galvanized steel backing, with colors, legend, and size appropriate to the location. Provide 1/4-inch grommets in corners for mounting.

G. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

H. Pressure sensitive industrial tape with adhesive backing and Helvetica lettering. The lettering shall be applied with a Kroy high performance labeling machine or equal. Tape shall be clear with black lettering.

2.12 SUBSTITUTIONS

A. Comply as applicable with Section 01 60 00 – Product Requirements or as indicated in each product specification. Equipment may be shown or specified in several ways:

B. Equipment may be shown or specified in several ways:

1. Manufacturer and catalogue or model number with the words "no substitutions," "no equal," "(manufacturer) only," or words of similar respect. Contractor shall furnish the specified item.

2. Several manufacturers and model numbers listed; or one manufacturer and model number, followed by "equals by (mfr A), (mfr B), (mfr C)," or words of similar respect.

a. If one of the manufacturers is listed on the drawings, that manufacturer shall be considered the basis of design. If none is so listed, the first manufacturer named in the Specification shall be considered the basis of design.

b. Where manufacturer's or supplier's name, style and catalog numbers are mentioned in the description of material and equipment in the specifications or on the drawings, it is to be understood that they are for the purpose of setting a standard.

c. If Contractor elects to furnish equipment other than the basis of design, he shall verify capacities, physical size, weight, HVAC requirements, methods of connection to other parts of the system, and all other relevant data. Contractor shall be responsible for informing the Design Professional of all changes required to other equipment, spaces, structure or systems in order to install the substituted equipment. He shall furnish all required shop drawings or sketches required for Design Professional to evaluate the required changes, and shall be responsible for all costs associated with such changes, including costs of design or engineering, if such are necessary, and costs of other trades.

3. Where manufacturer's or supplier's names are listed in conjunction with the manufacturer or supplier that is basis of design, they are given to approve the firm name only. Equipment or material submitted by such firms must meet the detailed technical specifications written for the respective item. Contractor shall be responsible for verifying capacities, physical sizes, weights, HVAC requirements, and methods of connection to other parts of the system, etc. Contractor shall furnish all required shop drawings for equipment, and for its connection and installation.

C. If any substituted items are submitted after contracts have been awarded, and there is any question of equality of such items, samples may be required to be submitted both for the item specified and that to be substituted, or, further proof of equality may be required to the entire satisfaction of the Design Professional. In no case shall additional remuneration be allowed because of the rejection of a substitute.

D. When the equipment is relocated to a place other than that shown on the drawings, or when equipment other than that specified is used, the Contractor shall pay the extra cost of required revisions such as structural steel, concrete, HVAC, piping, etc.

E. The Design Professional's costs to evaluate substitutions and to revise Drawings and Specifications because of substitutions will be paid by the Contractor.

2.13 SHOP DRAWINGS

A. Refer also to Division 00, 01 and other Division 26, 27, and 28 sections.

B. Furnish shop drawings, catalog cuts, performance data and other required data to the Design Professional for review for all material and equipment specified hereinafter. Sufficient data shall be submitted to show compliance with the requirements of the plans and specifications. All shop drawings submitted shall be first checked and corrected before submitting for approval. Approval for shop drawings by the Design Professional will not relieve the Contractor from responsibility for errors or omissions therein. All such errors or omissions must be made good by the Contractor irrespective of any approval by the Design Professional.

C. On submissions beyond the initial one, clearly identify changes made from the initial submittal other than those requested by the Design Professional. The Design Professional will review only those changes he requested and those identified by the Contractor.

D. Shop drawings required shall include, but not necessarily be limited to, the following:

1. Shop drawings, cuts and catalogue information showing appearance, dimensions, performance, weight, etc., of all equipment, appurtenances, etc.
2. Schedules of all materials showing type and manufacturer.
3. Wiring diagrams and schematics for equipment.
4. All special equipment and systems.
5. Any special constructions.
6. Other shop drawings as may be requested.

E. Digital files of Electrical work will not be provided for the purpose of shop drawing preparation. Digital files of architectural plans, elevations, sections, etc. may be available for background purposes; it is the responsibility of the Contractor to confirm availability prior to bid.

F. Facsimile submission of shop drawings will not be accepted as the submittal format. An advanced copy for starting the process may be faxed but hard copy submittals are to be submitted for actual review.

G. Electronic submission of shop drawings shall be permitted in the format as noted elsewhere in the specifications.

H. Shop drawings shall be submitted in a timely manner, taking due account of time requirements for processing, correcting and distributing the shop drawings to all persons or trades requiring the information, as well as time required for manufacture of the equipment. Design Professional will not be responsible for construction delays resulting from late submission of shop drawings, nor for delays caused by the need to correct and resubmit shop drawings which were not correct, which involved substituted equipment, or otherwise required review, correction and resubmission.

I. If Contractor elects to proceed to install equipment for which approved Shop Drawings have not been received, he does so at his own risk; Design Professional is not obligated to accept such equipment or work, nor will Design Professional be liable for claimed costs or delays required by correction of such work.

2.14 FLASHING AND ROOFING WORK

A. Comply as applicable to Division 07 – Thermal and Moisture Protection.

B. The Contractor shall perform all cutting, patching and sealing of roofs as required for the installation of all work under this Contract.

C. The contractor bears the complete responsibility for maintaining and obtaining the watertight integrity of the affected areas of the roofs both during and after the completion of construction.

D. The Contractor shall provide all base flashings, counter flashings, and hot applied roofing materials necessary to properly flash and seal the roofs as required and to prevent any water or moisture leakage whatsoever from occurring as a result of this work.

E. Unless noted otherwise, all flashings shall be minimum 24 gauge galvanized steel. Base flashings shall have minimum 4" roof flanges on all sides. Flanges of all base flashings shall be secured and stripped into existing roofing in accordance with the best practices and methods of the roofing trade for a watertight installation.

F. All joints and seams of all flashings shall be continuously soldered.

G. After installation, all exposed metal surfaces of base flashings shall be given two (2) applications of roofing coating.

H. All roofing work shall be performed by first class mechanics experienced in the roofing trade.

I. Contractor must exercise extreme care so as not to damage existing roofs while working thereon and he shall provide protection planking and plywood as required to achieve this result. Any damage to the existing roofs and their watertight integrity caused as a result of work being performed under this Contract shall be properly repaired by the Contractor to the satisfaction of and at no cost to the Owner.

PART 3 EXECUTION

3.1 VISIT THE SITE

A. Before submitting bid, visit the site of the work and be thoroughly familiarized with the conditions affecting the work. No extra payment will be allowed on account of extra work made necessary by failure to do so.

3.2 WORKMANSHIP

A. All work shall be installed in a first class, neat and workmanlike manner by mechanics skilled in the trade involved. All details of the installation shall be mechanically correct. Should the Design Professional direct removal, change, or installation of any equipments or systems not installed in a neat and workmanlike manner, such changes shall be made by the Electrical Contractor at no expense to the Owner.

B. Equipment shall be installed in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. The Contractor shall obtain these instructions from the manufacturer and these instructions shall be considered part of these specifications. Type, capacity, and all applications shall be suitable and shall operate satisfactorily for the purpose intended for the system.

C. Drawings are generally indicative of the work to be installed, but do not indicate all bends, offsets, fittings, junction / pull boxes, hand holes and specialties which may be required, or the exact locations of all conduit. Contractor shall investigate structure and finish conditions affecting his work and arrange his work accordingly; furnishing such items as may be required to meet such conditions. Contractor is responsible for exercising proper judgment to arrange his work and materials so as to avoid interference with other trades.

1. Riser diagrams and schematics generally indicate equipment to be used in various systems involved. This information may or may not be duplicated on the plans, but equipment shown on either plans or riser diagrams and schematics shall be provided as if shown on both.
2. All grades, elevations, dimensions and clearances of equipment shown on drawings are approximate and shall be verified at site.
3. Where work or equipment is referred to in singular terms, such reference shall be deemed to apply to as many items of work or equipment as required to complete entire installation.

D. All materials and equipment shall be new and shall conform to the grade, quality, and standards specified herein in every detail.

E. All materials and equipment shall be made in the USA.

F. All equipment offered under these specifications shall be limited to products regularly produced and recommended for the specified service. Ratings shall be in accordance with the Design Professional's data or other comprehensive literature made available to the public and in effect at this time.

3.3 LINES AND GRADES

A. Layout work and establish heights and grades for work in strict accordance with the intent expressed by the drawings and all the physical conditions at the building and be responsible for the accuracy of same.

3.4 FIELD MEASUREMENTS

A. Before ordering any material or doing any work, verify all measurements at the building and site and be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and measurements and those indicated on the drawings. Any difference which may be found shall be submitted to the Design Professional for consideration before proceeding any further with the work.

3.5 DELIVERY OF EQUIPMENT

A. Be responsible for delivery of equipment, unload and store in a manner not to interfere with the operation of other trades. Additional expense incurred because of equipment or material delivery delays shall be assumed by the responsible Contractor.

3.6 PROTECTION OF WORK

A. All work, equipment and materials shall be protected at all times.

B. All raceway openings shall be closed with caps or plugs during installation. All equipment shall be tightly covered and protected against dirt, water, plaster, paint and other foreign material or mechanical injury during entire progress of installation. Make good all damage caused either directly or indirectly by workmen employed to fulfill requirements of the Electrical Work.

3.7 REMOVAL OF RUBBISH

A. During the course of construction, periodically remove from the premises all rubbish resulting from work of this trade so as to prevent its accumulation. At the completion of the work contemplated under these Specifications remove from the building and site all rubbish and accumulated materials of whatever nature not caused by the other trades and leave work, and equipment free of all foreign matter including plaster, cement, and paint and leave in a clean, orderly, acceptable and usable condition.

3.8 COORDINATION WITH OTHER TRADES

A. Work in conjunction with each of the other trades to facilitate proper and intelligent execution of work with minimum interference.

B. Carefully examine all architectural structural, mechanical, plumbing, fire protection, and civil drawings and be responsible for the proper fitting of all material and equipment into the building as planned and without interference with other piping, ductwork, conduit or equipment. Proper judgment shall be exercised to secure best possible headroom, door and window clearance, and space conditions throughout; to secure neat arrangement for piping, equipment and conduit: and to overcome all local difficulties and interferences to best advantage. Approval for any and all changes to plans and specifications which may thus be incurred shall be obtained from the Design Professional before proceeding.

C. The Mechanical Contractor shall prepare preliminary sheet metal shop drawings suitable for use in coordinating his work with the work of other trades. The Mechanical Contractor will prepare and furnish CAD files of drawings at 3/8" = 1'-0" scale illustrating the coordination with all trades. Drawing will indicate equipment access requirements, piping, ductwork and conduit in relation to all structural elements of the construction, including floor elevations; steel locations, size, and elevations; partitions locations; door locations and direction of swing; and all other information required to assure coordination of the HVAC, sheet metal and piping trades and fire protection in relation to the Architectural function of the project. Coordination meetings will be held under the supervision of the Owner's Construction Manager and General Contractor. Each trade shall have proper representation at all coordination meetings for the purpose of detailing, on a print of the coordinated drawing mentioned above, the exact location and routing of their work. After the conclusion of the coordination at the working meetings, each trade shall sign the coordinated print, copies of which shall be distributed by the GC to all contractors and parties concerned including the Owner. A print of each final coordination CAD drawing with the participants contractors "signoff' signatures appended shall be submitted to the design professional for record.

D. If contractor installs work so as to cause interference with work of other trades, he shall make necessary changes in work to correct the condition without extra charge.

E. Dimensional layout plans of equipment rooms shall be made showing all bases, pads and inertia blocks required for electrical equipment. Include dimensions of bases, bolt layouts, details, etc.

F. Contractor shall furnish all necessary templates, patterns, etc. for installing work and for purpose of making adjoining work conform, furnish setting plans and shop details to other trades as required.

3.9 COORDINATION OF CONTROL EQUIPMENT

A. The HVAC Contractor shall furnish all starters, push buttons for local or remote control, controllers, pressure switches, aquastats, thermostats, float switches or similar items together with all appurtenances and accessories required to operate the equipment furnished under these specifications and necessary to perform the operating functions as specified, shown on the drawings, or otherwise required.

B. The HVAC Contractor will mount and provide power-wiring for all starters and will furnish and install all other safety switches or other line-disconnecting or protective devices. Where the starter and/or safety switch is an integral part of the equipment assembly, the assembly shall be furnished with the wiring complete between starter, controller and motor and the HVAC Contractor will make power connections only.

C. All control wiring to automatic-operated switches, pressure switches, aquastats or other devices which actuate the starter or other items associated with the systems shall be furnished, installed and wired by the HVAC Contractor. The HVAC Contractor will supply 120V electric power to the control panels for these special systems to the extent shown on HVAC Drawings. All other wiring (including additional power circuit if required) shall be the responsibility of the HVAC Contractor.

D. The HVAC Contractor shall carefully check the current characteristics available to each location before ordering motors.

E. If procurement requirements necessitate a change in voltage, phase, horsepower or other characteristics of any motor, the HVAC Contractor shall obtain approval of such change from the Design Professional and shall be responsible for necessary arrangements for notifying the HVAC Contractor, and shall pay the costs, if any, required by the change, including Engineering costs.

F. All HVAC equipment furnished and installed under this contract shall be furnished with full complement of control equipment, control wiring, conduit and all other items necessary for satisfactory operation.

G. The HVAC Contractor will complete all HVAC power connections, through the disconnect and/or thermal cutouts, starter and motor terminals. He will be responsible for final power connections.

H. The HVAC Contractor will be responsible for proper rotation of three phase equipment.

I. All HVAC work, equipment and material furnished under this Section shall be furnished and installed in accordance with the Automation Specifications – Division 23 and HVAC Specifications – Division 26.

J. All panels, relays, terminal boxes, contactors, circuit breakers, safety switches, motor starters and similar items shall be identified by Name, Function and/or Control. Nameplates shall be at least 1 inch x 3 inches with characters not less than a ¼ inch. They shall be made of two laminated black plastic sheets bonded with a middle sheet of white plastic and characters engraved in one black sheet to the depth of the white plastic. A typewritten list of nameplates shall be submitted to the Design Professional for approval before ordering same.

K. Provide pressure sensitive, self adhesive label indicating circuit number on the back of all device plates.

L. Provide pressure sensitive, self adhesive label indicating ‘Emergency’ on the front of all standby or emergency receptacles. Coordinate color with Architect.

M. Provide pressure sensitive, self adhesive label indicating ‘Computer’ on the front of all receptacles connected to the ‘CP**’ panelboards. Coordinate color with Architect.

3.10 ANCHORS AND GUIDES

A. Anchors shall be provided where shown and/or required for the proper control of stress in conduit due to expansion.

3.11 ACCESS

A. All equipment requiring maintenance or adjustment must be accessible. Items located above ceilings shall be located above accessible portions of the ceiling or above access panels provided by this Contractor. Manufactured items with internal components requiring access (whether integral with the enclosure or not) shall be provided with access panels. Access panels shall be provided in ductwork where required for maintenance or adjustment of internal components.

B. Provide access panels in walls and ceilings to give access to all control equipment, junction/pull boxes, and other similar electrical devices which could otherwise be accessible.

C. Access panels shall have not less than No. 16 U.S.S. gauge steel frame, not less than No. 14 U.S.S. gauge steel door, not less than 1/8” neoprene secured to the inside of the door and standard screw driver lock.

D. In unplastered masonry block walls, the height of the panels shall be a multiple of the height of the block courses. All access panels shall not be smaller than 12 inches wide by 18 inches unless otherwise indicated or directed, and shall be installed flush with the finished wall or ceiling and shall be painted with not less than two coats of paint to match adjacent walls.

E. In fire rated assemblies the access panels shall be fire rated.

3.12 FIRE STOPPING

A. All penetrations through fire-resistance-rated floor, fire resistance rated, floor/ceiling assemblies and roof construction and through fire-resistance-rated walls and partitions shall be fire stopped.

B. Penetrations to be fire stopped include both empty openings and those containing cables, pipes, ducts, conduits and any other items.

C. Fire rating of sealed penetrations shall meet or exceed the rating of the assembly being penetrated.

D. Materials shall be installed in accordance with manufacturer's recommendations and their UL listing.

3.13 CONDUIT AND EMT GENERALLY

A. Unless otherwise indicated or specified, all new conduit and EMT devices and controls shall be concealed in walls and ceilings, and wiring devices and controls shall be flush mounted, except in Equipment Rooms.

B. All conduit and EMT shall be installed as closely as possible to walls, columns and structural members so as to occupy a minimum of space. Conduit and EMT shall be run plumb and square with the building lines.

C. All conduits, EMT, fittings and supports shall be installed so as to preserve access to all outlet, junction and pull boxes, and fixtures.

D. All conduit, EMT and other work required by these specifications and by the applicable drawings will be laid out and installed with the complete work of all trades in mind. The Contractor is cautioned that close coordination between trades will be required for the successful completion of this work, and in case interference with the work of other trades should develop, the Design Professional shall determine which work is to be relocated, regardless of which was first installed at no additional expense to the Owner.

E. All conduit, EMT and wireways shall be kept a sufficient distance from other work to permit a clearance of not less than one (1) inch between raceway and the finished covering of ducts, cold water piping, valves and fittings and all adjacent work. Maintain a minimum of three (3) inches from hot water and steam piping.

F. The drawings are generally indicative of the work to be installed and do not indicate all offsets, bends, fittings, supports, boxes, access panels and similar parts which may be specified or required. Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange all his work accordingly furnishing such fittings, bends, supports, boxes, access panels and other similar parts as may be required to meet such conditions.

G. Conduits and EMT penetrating walls and floors shall be installed so that water proofing can be flashed into and around them. Sleeves through exterior walls below grade shall have the annular space between the conduit and/or EMT and sleeve caulked watertight. Sleeves in masonry walls shall be standard weight steel pipe.

H. All exposed conduits in occupied areas must be provided with heavy, solid pattern, painted escutcheons where such materials pass through wall, floors, or ceilings. Escutcheons are not required in equipment rooms or unfinished areas.

3.14 WIRING METHODS

A. All wiring systems shall be contained in raceways. All wiring devices and conduit shall be concealed. Generally, except where otherwise specified or indicated on drawings, wiring shall consist of insulated conductors in rigid zinc-coated steel conduit or EMT concealed within the building construction. Where ceiling system consist of exposed precast plank, wiring shall be run concealed inside plank, and run concealed within the walls. Where conduits must run through exposed joist, all horizontal conduit shall be run fastened along top joist member and conduit dropped down to each lighting fixture, backstop, etc. All conduit within new walls and through

existing building shall be run concealed. Where branch circuits are to be contained in existing construction, and there is hollow spaces within the construction, a flexible conduit system (Greenfield) may be fished within the wall, otherwise cut and patch existing structure to conceal conduit.

B. Wire and cable work shall consist of the various types of wires, cable, connectors, and fittings for complete wire and cable systems as required for the Electrical work. Note that raceways shall be provided for all wiring systems including lighting power, control, paging, intercom, fire alarm, and telephone.

C. Wire and cable shall not be drawn into conduit and raceways until conduit is cleaned. The inside of conduit and raceway shall be dry and clean before wires are pulled.

D. Care shall be exercised in pulling to avoid damage to the wire of cable. Lubricants shall not be used for pulling wire or cable, if the character of the lubricant would otherwise damage the conductors, insulation or jacket. Lubricants used shall be approved by the Design Professional.

E. Wire and cable for feeders, sub-feeders, control and branch circuit wiring shall be color coded. Color coding scheme shall be maintained throughout the project. Submit scheme to Design Professional prior to installation.

F. The switch legs for local wall switches shall have distinctive color coding scheme.

G. Feeder cables shall be tagged in all pull boxes, wireways, and wiring gutters of panels. Tags shall identify wire or cable number and/or piece of equipment served. Tags shall be of non-combustible materials.

3.15 GENERAL PROVISIONS FOR WIRE AND CABLE WORK

A. Branch lighting and receptacle circuits are two wire circuits with individual neutral conductors. Note that branch circuit numbers indicated on drawings are for clarification of circuits only and do not necessarily indicate final connections to panelboard. Branch circuits shall be arranged to balance the loads across the phases of the panelboard feeders. Contractor shall, under final operating conditions, rearrange (rotate) new and existing branch circuits so that a minimum current will flow in each feeder’s neutral cable, with all panelboard branch circuits in use.

B. Contractor shall provide additional conductors as required for 3 way, 4 way switching, separate ballast switching, emergency battery packs, if indicated on drawings, wiring for night lighting if fixtures are so designated, etc.

C. All wiring in cabinets, panelboards, pull boxes, and junction boxes shall be neatly tied and held with Ty-Rap nylon ties.

3.16 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/ cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Maintain electrical service and feeders to occupied areas and operational facilities. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate or abandon existing wiring as noted. At no time shall the life safety or fire alarm systems to the building be without power.

E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

F. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

I. Provide flexible metallic conduit for transformers, motor connections, lighting fixtures, and other electrical equipment connections, where subject to movement and vibration.

J. Provide liquid-tight flexible metallic conduit for connection of motors and other electrical equipment where subject to movement and vibration, and also where connections are subjected to one or more of the following conditions:

1) Exterior location;
2) Moist or humid atmosphere where condensate can be expected to accumulate;
3) Corrosive atmosphere;
4) Water spray;
5) Dripping oil, grease or water;
6) Inside air handling units;
7) To all pump motors.

K. Fasten identification markers to each electrical power supply wire/cable conductor which indicates their voltage, phase and feeder number.

L. Maximum length of all types of flexible conduit shall be 72”.

3.17 MANNER OF INSTALLATION

A. All work shall be installed in a first class, neat and workmanlike manner by mechanics skilled in the trade involved. All details of the installation shall be mechanically and electrically correct.

B. The drawings are generally indicative of the work to be installed but do not indicate all bends, fittings, boxes and specialties which may be required or the exact locations affecting all the work. The CONTRACTOR shall arrange the work accordingly, and furnish such fittings and junction boxes as may be required to meet such conditions at no additional cost to the OWNER, and arrange all runs of conduit to clear beams and other obstructions.

C. Removable panels required for access shall be provided by the CONTRACTOR.

3.18 INSTALLATION OF PULL AND JUNCTION BOXES

A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8-inches square by 4-inches deep.

B. Cable Supports: Install clamps, grids or devices to which cables may be secured. Arrange cables so they may be readily identified. Support conductors inside boxes.

C. Mount pullboxes in inaccessible ceilings with the covers flush with the finished ceiling.

D. Size: Provide pull and junction boxes for telephone, signal and other systems at least 50 percent larger than would be required by Article 314 or NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems. A maximum of (2) 90° bends in conduit or EMT shall occur between junction boxes.

3.19 INSTALLATION OF IDENTIFICATION PRODUCTS

A. Install identification devices in accordance with manufacturer's written instructions and requirements of the NEC.

1) All electrical equipment shall be required to be labeled to comply with OSHA and ANSI/ASME A13.1-2007 standards for the identification of systems.

2) The marking system shall identify the voltage of the contents.

3) All equipment must be identified using phenolic nameplates and labeled in accordance with the nomenclature used on the drawings and compatible with the MIMS System.

B. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

C. Identify Junction, Pull and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange

background. Install on outside of box cover. Also label box covers which identify contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.

D. Conductor Color Coding: Provide color coding for secondary service, feeder and branch circuit conductors throughout the project.

1) Use conductors with color factory-applied the entire length of the conductors except as follows:

a) The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.

(1) Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal point and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

2) Three-phase color coding, Phase A, B, and C order – 480/277 volt shall be brown, orange, yellow, and 208/120 volt shall be black, red, and blue.

E. Power Circuit Identification: Securely fasten identifying metal tags or aluminum wraparound marker bands to cables, feeders and power circuits in vaults, pullboxes, junction boxes, manholes and switchboard rooms with 1/4 inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55 lb. test monofilament line or one-piece self-locking nylon cable ties.

F. Tag or label conductors with vinyl film type wire markers as follows:

1. Multiple Circuits: Provide legend indicating source, voltage, circuit number and phase for branch circuit wiring. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.

2. Match identification markings with designations used in panelboards shop drawings, Contract Documents and similar previously established identification schemes for the facility's electrical installations.

G. Apply warning, caution and instruction signs and stencils as follows:

1) Install warning, caution or instruction signs where required by NEC, where indicated or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

H. Install equipment/system circuit/ device identification as follows:

1) Apply mechanically fastened equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems. Except as otherwise indicated, provide single line of text, with 1/2-inch high lettering on 1-1/2-inch high label (2-inch high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Mechanically apply labels for each unit of the following categories of electrical equipment:

a) Panelboards, electrical cabinets and enclosures

b) Access doors and panels for concealed electrical items

c) Motor starters and VFD's

d) Each feeder circuit breaker or fused switch

e) Disconnect switches

f) Swithgear sections

g) Transformers

h) Lighting control panels

2) Apply circuit/control/items designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide frames, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

I. Provide labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

3.20 LOCATION OF OUTLETS

A. This Contractor shall examine all architectural drawings and details before locating outlets. Outlets shall be placed as required to harmonize with moldings, panels, etc. Outlet locations shall not be obtained from scale dimensions on electrical drawings but from measurements on architectural plans and/or details.

B. If an outlet is installed by this Contractor in such a location as to be out of proper relation to beams, walls, or other details of the building, its location shall be corrected by, and at the expense of this Contractor, at the direction of the Design Professional.

3.21 MOTOR CONNECTIONS AND MECHANICAL EQUIPMENT

A. All electric motors furnished under the General, HVAC, and Plumbing Specifications will be installed by each respective Contractor.

B. The Electrical Contractor shall provide the necessary control wiring, VFD's, disconnects, motor starters, and control equipment, set and wire the units as specified. Control and pilot devices shall be wired by the Electrical Contractor. All interlock wiring shall be provided by the Electrical

Contractor. Provide disconnect switches for all motors and packaged HVAC equipment whether or not shown on the drawings.

C. The Electrical Contractor shall run power and control wiring system for the various points indicated to the motor outlets and connect up complete and ready for operation.

D. Switch, wire, and conduit sizes are based on manufacturer's published literature. Any changes required due to the nameplate information on the equipment shall be made by this Contractor at no additional cost to the Owner.

E. The horsepower of motors or wattage of equipment indicated on electrical plans or in schedules on drawings is the estimated horsepower or wattage requirement of equipment furnished under other sections of the specifications. All feeders, conduit and wiring, motor starters and circuit breakers shall be of the sizes and capacities to suit the horsepower of the motors or wattage of equipment actually furnished under the various sections of the specifications. However, in no case shall the feeders and branch circuits, and circuit breakers be of smaller capacities or sizes than those indicated on drawings or specified. The Contractor shall coordinate the requirements of the various sections of the project specifications and provide suitable equipment and electrical facilities therefore in order that the above requirements may be met.

F. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer’s instructions for equipment furnished under other sections.

G. Determine connection locations and requirements.

H. Sequence rough-in of electrical connections to coordinate with installation of equipment.

I. Sequence electrical connections to coordinate with start-up of equipment.

J. Electrical Contractor shall size motor overload protection in the field. Sizes shall be based on the motor’s name plate data.

K. All motor frames shall be grounded. Electric power, control and grounding connections shall be factory wired to an outlet box or terminal strip enclosure on the apparatus for easy connection by the Contractor.

L. Motors for use on equipment with variable speed drives shall be compatible for drive usage and be constructed per NEMA Standard MG-1 Part 31. Coordinate with variable speed drive manufacturer for motor requirements and drive output characteristics. All such motors shall have their cases bonded to the driven machinery frame with a ground strap.

M. Disconnect switches shall be furnished by the equipment manufacturer. If disconnect switches are not available from the equipment manufacturer they shall be provided by the Electrical Contractor. Coordinate with the Architectural, Mechanical, Plumbing, Fire Protection, and Civil drawings and specifications.

N. Disconnect switches shall be as specified within the equipment specifications and shall suit the environment in which installed.

3.22 COLOR CODING OF RACEWAYS AND BOXES

A. Junction boxes shall be primed and painted with the following colors:

480/277V	Dark Blue
208/120V	Light Blue
Voice/Data/Communication	Yellow
Fire Alarm	Red

3.23 ELECTRICAL DRAWINGS

A. The Contractor shall note that the Electrical Drawings are intended to indicate only the extent diagrammatically, general character, and locations of the work included. Work intended but having minor details obviously omitted or not shown shall be furnished and installed complete to perform the functions intended. For building details the Architectural and Structural Drawings, and Mechanical, Plumbing, and Fire Protection Drawings and Specifications shall be followed and the work of the Electrical Drawings and Specification shall be coordinated and fitted thereto.

B. Riser diagrams are schematic and are provided to indicate the system in general to be installed. This information may or may not be duplicated on the plans; however, equipment shown on either the plans or riser diagrams and schematics shall be provided as if shown on both.

C. In general, the number of wires in each branch circuit raceway has not been indicated, but shall be provided as required.

D. Arrangements of conduit wiring and equipment that differ materially from the obvious intent of the drawing will not be permitted except where necessary to avoid interferences and then, or except when, specifically approved by the Design Professional.

E. In case of conflict between that Specified and the Drawings, the proper interpretation shall be made by the Design Professional whose decision shall be binding.

3.24 ABANDONMENT, REMOVAL, AND RELOCATIONS

A. All removed equipment and material not wanted by the Owner shall become the property of the Contractor and shall be removed immediately from the site.

B. Any existing apparatus or device required to remain in operation, although not specifically shown or mentioned, shall be connected or reconnected and supplied from an available source of power.

C. Remove all equipment, backboxes, branch circuit wiring and control wiring for devices and equipment that are not required in the new facilities.

D. Any existing apparatus or device to be retained shall be disconnected and relocated and reinstalled as required to allow for new wall or ceiling finishes.

E. Provide new typed panel schedules on each new and existing panelboard and switchboard describing each circuit.

3.25 ELECTRICAL EQUIPMENT LOCATIONS

A. The plans accompanying this specification have been drawn to scale and indicate the general arrangement required, but small-scale plans are diagrammatic and the Electrical Contractor shall be guided by the mounting heights noted herein or on the drawings.

B. All locations are subject to changes that will ease installation or may be necessary to avoid obstacles in building construction.

C. The Electrical Contractor shall verify all dimensions and conditions at the site and check the layout for sizes and clearances to be sure that the apparatus and materials he proposed to furnish may be installed and operate satisfactorily in the space allotted to it. Equipment and wiring shall be installed in accessible locations.

D. Before installing any work, the Electrical Contractor shall have obtained final locations of all outlets and equipment from the Mechanical, Plumbing, and Fire Protection Contractors, and he shall examine drawings for other trades and avoid interferences with their work. In cases of interference, priority of installation will not relieve the Electrical Contractor of his responsibility to avoid interferences.

E. No changes are to be made in the original design without the written approval of The Design Professional.

F. Unless otherwise located to comply with "Handicap Regulations" or indicated on Electrical or Mechanical drawings, mounting heights shall be as follows:

Wall Switches	48” above finished floor
Convenience Outlets	18” above finished floor unless otherwise indicated or located above countertops and 48” above finished floor in Mechanical Rooms
Starters, Disconnect Switches and Enclosed Circuit Breakers	5'-0" to center line from finished floor
Panelboards	6'-6" to top circuit breaker
Fire Alarm Horn/Strobes	80” above finished floor
Fire Alarm Pullstations	As noted
Voice/Data Outlets	18” above finished floor unless otherwise indicated
Video/Cable TV Outlets	Coordinate with Architect prior to rough-in

END OF SECTION 260500

SECTION 26 05 13

MEDIUM-VOLTAGE CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section Includes:
1. Medium voltage cable.
2. Cable terminations.
3. Fireproofing tape.
4. Underground cable markers.
5. Bedding and cover materials.

1.3 REFERENCES

A. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

A. Product Data: Submit for cable, terminations, and accessories.

B. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual sizes and locations of cables.

B. Operation and Maintenance Data: Submit instructions for testing and cleaning cable and accessories.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cable ends from entrance of moisture.

PART 2 PRODUCTS

2.1 MEDIUM VOLTAGE CABLE

A. Manufacturers:
1. Diamond Wire & Cable Co.
2. Essex Group Inc.
3. General Cable Co.
4. The Okonite Company.
5. The Kerite Company.
6. Pirelli Cable Corporation.
7. Rome Cable Corporation.
8. Southwire.

B. Voltage: 15 kV.

C. Insulation: EPR

D. Insulation Level: 133 percent of operating voltage.

E. Cable Continuous Operating Temperature Rating: MV-105.

F. Configuration: Single conductor.

G. Conductor Material: Aluminum.

H. Conductor Construction: Compact stranded.

I. Conductor Shield: Foil.

J. Non-Armor Jacket: Thermo-plastic rubber with red extruded identification stripe.

2.2 CABLE TERMINATIONS

A. Voltage: 15 kV.

B. Location: Indoor at equipment, and outdoor at manholes.

C. Conductor Quantity: Single core.

D. Type: Separable molded elbow connectors.

2.3 FIREPROOFING TAPE

A. Manufacturers:
   1. 3M Electrical Products Division.
   2. Plymouth Rubber Co., Bishop Division.

B. Product Description: Flexible, conformable fabric, coated on one side with flame retardant, flexible polymeric or chlorinated elastomer. Non-corrosive to and compatible with cable sheaths jackets. Does not support combustion.

C. Width: Approximately 3 inches.

D. Thickness: Not less than 0.03 inch.

E. Weight: Not less than 2.5 pounds per square yard.

2.4 PULLING CABLES IN DUCTS, MANHOLES

A. Medium-voltage cables shall be pulled into ducts and utility tunnels with equipment designed for this purpose, including power-driven winch, cable-feeding flexible tube guide, cable grips, and lubricants. A sufficient number of trained personnel and equipment shall be employed to ensure the careful and proper installation of the cable.

B. Cable reel shall be set up at the side of the manhole or tunnel hatch opening and above the duct or hatch level, allowing the cable to enter through the opening without reverse bending. Flexible tube guide shall be installed through the opening in a manner that will prevent the cable from rubbing on the edges of any structural member.

C. Cable shall be unreeled from the top of the reel. Payout shall be carefully controlled. Cable to be pulled shall be attached through a swivel to the main pulling wire by means of a pulling eye. Woven-wire cable grips shall be used to grip the cable end when pulling small cables and short straight lengths of heavier cables.

D. Pulling eyes shall be attached to the cable conductors to prevent damage to the cable structure. Pulling eyes and cable grips shall be used together for nonmetallic sheathed cables to prevent damage to the cable structure.

E. Cables shall be liberally coated with a suitable cable-pulling lubricant as it enters the tube guide or duct. Nonmetallic sheathed cables shall be covered with wire-pulling compounds when required which have no deleterious effects on the cable. Rollers, sheaves, or tube guides around which the cable is pulled shall conform to the minimum bending radius of the cable.

F. Cables shall be pulled into ducts at a speed not to exceed 50 feet per minute and not in excess of maximum permissible pulling tension specified by the cable manufacturer. Cable pulling using a vehicle shall not be permitted. Pulling operations shall be stopped immediately with any indication of binding or obstruction and shall not be resumed until such difficulty is corrected.

2.5 SPLICES AND TERMINATIONS

A. Cable splices made up in manholes or utility tunnels shall be firmly supported on cable racks as indicated. No cable splices shall be pulled in ducts. Cable ends shall overlap at the ends of a section to provide sufficient undamaged cable for splicing. Cables to be spliced in manholes or utility tunnels shall overlap the centerline of the proposed joint by not less than 2 feet.

B. Cables cut in the field shall have the cut ends immediately sealed to prevent entrance of moisture. Nonleaded cables shall be sealed with rubber tape wrapped down to 3 inches from the cable end. Rubber tape shall be cover-wrapped with polyvinylchloride tape. Splices shall be made in manholes or junction boxes, except where cable terminations are specifically indicated. Splicing and terminating of cables shall be expedited to minimize exposure and cable deterioration.

C. Cables shall be terminated utilizing molded rubber terminations and shall be provided with adequate means for making external connections to the cable conductors of single-conductor cables; protecting the cable insulation against moisture, oil, or other contaminant; physically protecting and supporting cables, and maintaining the insulation level of the cable. Molded rubber terminations shall be field fabricated from termination kits supplied by and in accordance with the termination manufacturer’s recommendations for the type, size, and electrical characteristics of the cable.

D. Installation shall include built-up or prefabricated heat or cold shrink stress-relief cones at the terminals of all shielded cables rated 15 kV and above, ungrounded.

E. Cable splices shall be with 600 Amp Deadbeak separable connectors supplied by and in accordance with the cable manufacturer's recommendations for the type, size, and electrical characteristics of the cable specified. Cable splices in manholes shall be located midway between cable racks on walls of manholes and supported with cable arms at approximately the same elevation as the enclosing duct. Separable connectors shall have insulating plug with cap, capacitive test point, and shield/drain wire.

F. Cable splices in junction boxes shall be installed on cable racks or by other approved methods which will minimize physical stress on the splice connections. Splices shall be supported at approximately the same elevation as the installed cable except where space limitations or existing cable length limitations make this method impractical or impossible.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

B. Verify conduit, duct, and manholes are ready to receive cable.

C. Verify routing and termination locations of cable prior to rough-in.

3.2 PREPARATION

A. Use swab to clean conduits and ducts before pulling cables.

3.3 INSTALLATION

A. Avoid abrasion and other damage to cables during installation.

B. Use suitable manufacturer approved lubricants and pulling equipment.

C. Sustain cable pulling tensions and bending radii below manufacturer's recommended limits.

D. Ground cable shield at each termination and splice.

E. Install cables in manholes along wall providing longest route.

F. Arrange cable in manholes to avoid interference with duct entrances.

3.4 FIREPROOFING

A. Apply fireproofing tape to cables when installed in manholes, cable rooms, pull boxes, or other enclosures.

B. Smooth out irregularities, at splices or other locations, with insulation putty before applying fireproofing tape.

C. Apply fireproofing tape tightly around cables spirally in half-lapped wrapping or in butt jointed wrapping with second wrapping covering joints first.

D. Extend fireproofing 1 inch into conduit or duct.

E. Install tape with coated side toward cable.

F. Install random wrappings of plastic tape around fireproofing tape to prevent unraveling.

G. Install fireproofing to withstand a 200 Ampere arc for 30 seconds.

3.5 FIELD QUALITY CONTROL

A. Inspect exposed cable sections for physical damage.

B. Inspect cable for proper connections, and phase rotation.

C. Inspect shield grounding, cable supports, and terminations for proper installation.

D. Each shall be tested per NETA requirements and after the installation of high-voltage power cables has been completed, including splices, joints, and terminations, and before the cable is energized. Test equipment, labor, and technical personnel shall be provided as necessary to perform the electrical acceptance tests.

E. Arrangements shall be made to have tests witnessed and approved by the Contracting Officer. Each power-cable installation shall be completely isolated from extraneous electrical connections at cable terminations and joints. Safety precautions shall be observed. Test data shall be recorded and shall include identification of cable and location, megohm readings versus time, leakage current readings versus time, and cable temperature versus time.

F. Final acceptance shall depend upon the satisfactory performance of the cable under test. No cable shall be energized until recorded test data have been approved by the Contracting Officer Final test reports shall be provided to the Contracting Officer. Reports shall be sealed by a professional engineer and have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Report."

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect installed cables from entrance of moisture.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes building wire and cable; armored cable; metal clad cable; and wiring connectors and connections.

B. Related Sections:
1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.
2. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
3. Section 31 23 23 - Fill: Requirements for backfill to be placed by this section.

1.3 REFERENCES

A. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.
2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:
1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.4 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
1. Solid conductor for feeders and branch circuits 10 AWG and smaller.

2. Stranded conductors for control circuits.
3. Conductor not smaller than 12 AWG for power and lighting circuits.
4. Conductor not smaller than 16 AWG for control circuits.
5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.

B. Wiring Methods: Provide the following wiring methods:
1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN -2 insulation, in raceway or Metal Clad (MC) Cable.
2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN -2 insulation, in raceway.
3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN -2 insulation, in raceway or Metal Clad (MC) Cable.
4. Wet or Damp Interior Locations: Use only building wire, Type XHHW -2 insulation, in raceway.
5. Exterior Locations: Use only building wire, Type XHHW -2 insulation, in raceway.
6. Underground Locations: Use only building wire, Type XHHW -2 insulation, in raceway.

1.5 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper unless indicated as aluminum or "AL".

B. When aluminum conductor is substituted for copper conductor, size to match circuit requirements, terminations, conductor ampacity and voltage drop.

1.6 SUBMITTALS

A. Product Data: Submit for building wire and each cable assembly type.

B. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

C. Test Reports: Indicate procedures and values obtained.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and circuits.

1.8 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.10 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 PRODUCTS

2.1 GENERAL BUILDING WIRE

A. Manufacturers:
1. AETNA.
2. American Insulated Wire Corp.
3. Colonial Wire.
4. Encore Wire.
5. General Cable Co.
6. Republic Wire.
7. Rome Cable.
8. Service Wire Co.
9. Southwire.
10. Superior Essex.
11. Carol Cable Co. Inc.
12. Draka.
13. Tyco.
14. Pyrotenax.
15. Raychem.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper

D. Insulation Voltage Rating: 600 volts.

E. Insulation Temperature Rating: 90 degrees C.

2.2 METAL CLAD CABLE

A. MC cable shall be a galvanized spiral steel assembly with 90ºC THHN copper wires included and approved fittings and couplings by AFC Company. Cable shall have green insulated ground wire. Use only where cable can be concealed.

B. MC cable shall be used only when concealed above ceilings or in walls. Install all exposed wiring in raceway, including wiring in closets. Extend raceway from surface mounted panelboards to an accessible location above ceiling. Provide junction box when transitioning from raceway to MC cable.

2.3 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify interior of building has been protected from weather.

B. Verify mechanical work likely to damage wire and cable has been completed.

C. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:
1. Pull conductors into raceway at same time.
2. Install building wire 4 AWG and larger with pulling equipment.

E. Special Techniques - Cable:
1. Protect exposed cable from damage.
2. Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.
3. Use suitable cable fittings and connectors.

F. Special Techniques - Wiring Connections:
1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.

5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
7. Terminate aluminum conductors with tin-plated, aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.
8. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

G. Install solid conductors for branch circuits 10 AWG and smaller.

H. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.

I. Size lugs in accordance with manufacturer’s recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

J. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

K. Coordinate cable installation with other Work.

L. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

M. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

N. Conceal all cable in finished spaces.

O. Keep conductor splices to a minimum.

P. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cables in individual circuits. Make terminations so there is no bare conductor at the terminal.

Q. Increase branch circuit wire size to limit voltage drop to 3% at full load conditions.

R. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

S. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

T. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

U. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

V. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

W. Fasten identification markers to each electrical power supply wire/cable conductor which indicates their voltage, phase and feeder number.

X. Unless otherwise indicated, each single phase branch circuit shall consist of a respective insulated phase conductor, an insulated dedicated neutral conductor, and a separate insulated equipment ground wire.

Y. All 120 V branch circuits between 60’ and 100’ in length shall be circuited with a minimum of #10 AWG wire. Branch circuits between 100’ and 150’ in length shall be circuited with a minimum of #8 AWG wire. Wire sizes shall be increased to limit voltage drop to three percent (3%).

Z. Provide separate neutral conductor and ground wire for each branch circuit. Provide separate ground wire in each feeder circuit.

3.4 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

C. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.

D. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.

E. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper function. Correct malfunctioning units, and retest to demonstrate compliance.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Building perimeter ground system.
3. Wire.
4. Grounding well components.
5. Mechanical connectors.
6. Exothermic connections.

B. Applications of electrical grounding and bonding work in this section includes the following:
1. Electrical power systems
2. Raceways
3. Enclosures
4. Equipment
5. Lighting fixtures
6. Underground metal piping
7. Underground metal water piping
8. Underground metal structures
9. Metal building frames
10. Grounding electrodes
11. Separately derived systems
12. Service equipment
13. Lighting standards
14. Interior metallic piping
15. Water service

C. GROUNDING AND BONDING IN GENERAL
   1. Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including but not limited to, cables/wires, connectors, solderless lug terminals, bonding jumper braid, surge arresters and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL and IEEE requirements and with established industry standards for those applications indicated.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
   2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.
   2. NFPA 99 - Standard for Health Care Facilities.

1.4 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
   1. Metal underground water pipe.
   2. Metal building frame.
   3. Concrete-encased electrode.
   4. Ground ring.
   5. Rod electrode.
   6. Plate electrode.
   7. Concrete reinforcing.

1.5 DESIGN REQUIREMENTS

A. Construct and test grounding systems for access flooring systems on conductive floors accordance with IEEE 1100.

1.6 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.7 SUBMITTALS

A. Product Data: Submit data on grounding electrodes and connections.

B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

C. Manufacturer's Installation Instructions: Submit for active electrodes.

1.8 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and grounding electrodes.

1.9 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum ten years documented experience.

1.11 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.13 COORDINATION

A. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
   1. Erico, Inc.
   2. O-Z Gedney Co.
   3. Thomas & Betts, Electrical.

B. Product Description:
   1. Material: Copper-clad steel.
   2. Diameter: 5/8 inch.
   3. Length: 10 feet.

C. Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: #4/0 AWG.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

E. Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC or as shown on the drawings if oversized by Engineer.

F. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 4 AWG and larger shall be permitted to be identified per NEC.

G. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

H. Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.

I. Telecom System Grounding Riser Conductor: Telecommunications Grounding Riser shall be a 1/0 AWG insulated stranded copper grounding conductor unless indicated otherwise.

J. Electrical System Grounding: Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.3 ELECTRICAL GROUNDING CONNECTION ACCESSORIES

A. Provide electrical insulating tape, heat shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service indicated.

2.4 BONDING JUMPER BRAID

A. Copper braided tape, constructed of 30-gauge bare copper wires and properly sized for indicated applications.

2.5 FLEXIBLE JUMPER STRAP

A. Flexible flat conductor, 480 strands of 30-gauge bare copper wire; 3¾”wide, 9½ “ long; 48, 250 CM. Select braid with holes sized for 3/8” diameter bolts, and protect braid with copper bolt hole ends.

2.6 BONDING PLATES, CONNECTORS, TERMINALS, AND CLAMPS

A. Provide bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.

2.7 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.8 TELECOMMUNICATION SYSTEM GROUND BUSBARS

A. Provide solid copper busbar, pre-drilled from two-hole lug connections with a minimum thickness of 1/4 inch for wall and backboard mounting using standard insulators sized as follows:
   1. Room Signal Grounding: 12 inches x 4 inch. (Located in each Server Room, IDF, and AV Closet).
   2. Master Signal Ground: 24 inches x 4 inch. (Located in MDF).

2.9 GROUND CONNECTIONS

A. Below Grade: Exothermic-welded type connectors.

B. Above Grade:
   1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.
   2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
   3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.
   4. Cable Shields: Make ground connections to multipair communications cables with metallic shields using shield bonding connectors with screw stud connection.

5. Equipment rack and cabinet ground bars. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 3/8 inch x ¾ inch.

2.10 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.11 SPLICE CASE GROUND ACCESSORIES

A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 6 AWG insulated ground wire with shield bonding connectors.

2.12 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS by 24 inches long clay tile, or concrete pipe with belled end.

B. Well Cover: Cast iron or fiberglass with legend “GROUND” embossed on cover.

2.13 MECHANICAL CONNECTORS

A. Manufacturers:
1. Erico, Inc.
2. ILSCO Corporation.
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.14 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Copperweld, Inc.
2. ILSCO Corporation.
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

B. Installer of grounding shall examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 PREPARATION

A. Remove paint, rust, mill oils, and surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods as specified.

3.4 INSTALLATION

A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus or bushing.

D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

E. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.

F. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

G. Route properly sized (NEC Article 250) grounding conductors with each feeder and branch circuit.

H. Ground each separately-derived system as follows:
   1. The grounded conductor of the separately derived system shall be bonded to the nearest available point of the interior metal water piping system in the area served by the separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. The bonding jumper shall be sized in accordance with the NEC.

I. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors and plumbing systems.

J. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

K. Install rod electrodes approximately every 60 feet around perimeter of building interconnected with #4/0 ground wire.

L. Install grounding and bonding conductors concealed from view.

M. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

N. Install grounding electrode conductor and connect to reinforcing steel in foundation footing. Electrically bond steel together.

O. Bond together metal siding not attached to grounded structure; bond to ground.

P. Bond together reinforcing steel and metal accessories in fountain structures.

Q. Connect to site grounding system, and each exterior lighting pole.

R. Bond to lightning protection system.

S. Install continuous grounding for underground cold water system and building steel.

T. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

U. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

V. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 SYSTEM GROUNDING

A. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.

B. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

3.6 EQUIPMENT GROUNDING

A. Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.7 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.8 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS

A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

B. Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing medium or high voltage conductors, sized per NEC except that minimum size shall be #4/0 AWG. Bond the equipment grounding conductors to the switchgear ground bus, to all manhole hardware and ground rods, to the cable shielding grounding provisions of medium or high voltage cable splices and terminations, and equipment enclosures.

C. Lighting Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

D. Metallic Conduit: Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

3.9 SECONDARY EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service

B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
   1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
   2. Provide a supplemental ground electrode and bond to the grounding electrode system.

C. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.

D. Switchgear, Switchboards, Unit Substations, and Motor Control Centers:
   1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
   2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
   3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

E. Transformers
   1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
   2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system or the ground bar at the service equipment.

F. Conduit Systems
   1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
   2. Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
   3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

H. Boxes, Cabinets, Enclosures, and Panelboards
   1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
   2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
   3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.10 CORROSION INHIBITORS

A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.11 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.12 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to the electrical grounding electrode system.

3.13 TELECOMMUNICATIONS SYSTEM

A. Bond telecommunications system grounding equipment to the electrical grounding electrode system.

B. Furnish and install all wire and hardware required to properly ground, bond and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.

C. Ground bonding jumpers shall be continuous with no splices. Use the shortest length of bonding jumper possible.

D. Provide ground paths that are permanent and continuous with a resistance of 1 ohm or less from raceway, cable tray, and equipment connections to the building grounding electrode. The resistance across individual bonding connections shall be 10 milliohms or less.

E. Below-Grade Grounding Connections: When making exothermic welds, wire brush or file the point of contact to a bare metal surface. Use exothermic welding cartridges and molds in accordance with the manufacturer’s recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly cleaned the joint area. Notify the Resident Engineer prior to backfilling any ground connections.

F. Above-Grade Grounding Connections: When making bolted or screwed connections to attach bonding jumpers, remove paint to expose the entire contact surface by grinding where necessary; thoroughly clean all connector, plate and other contact surfaces; and apply an appropriate corrosion inhibitor to all surfaces before joining.

G. Bonding Jumpers:
   1. Use insulated ground wire of the size and type shown on the Drawings or use a minimum of 6 AWG insulated copper wire.
   2. Assemble bonding jumpers using insulated ground wire terminated with compression connectors.
   3. Use compression connectors of proper size for conductors specified. Use connector manufacturer's compression tool.

H. Bonding Jumper Fasteners:
   1. Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or the clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten the plain end of a bonding jumper wire by slipping the plain end under the conduit strut clamp pad; tighten the clamp screw firmly. Where appropriate, use zinc-plated external tooth lockwashers.
   2. Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers, and nuts. Install protective cover, e.g., zinc-plated acorn nuts on any bolts extending into wireway or cable tray to prevent cable damage.
   3. Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lockwashers, and nuts.
   4. Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lockwashers.

3.14 ELECTRICAL ROOM GROUNDING

A. Building Earth Ground Busbars: Provide ground busbar hardware at each electrical room and connect to pigtail extensions of the building grounding ring.

3.15 COMMUNICATION ROOM GROUNDING (TR/TER/AV CLOSETS)

A. Telecommunications Ground Busbars:
   1. Provide communications room telecommunications ground busbar hardware at 18 inches above finish floor.
   2. Connect the telecommunications room ground busbars to other room grounding busbars provided by Others.

B. Telephone-Type Cable Rack Systems: aluminum pan installed on telephone-type cable rack serves as the primary ground conductor within the communications room. Make ground connections by installing the following bonding jumpers:
   1. Install a 6 AWG bonding between the telecommunications ground busbar and the nearest access to the aluminum pan installed on the cable rack.
   2. Use 6 AWG bonding jumpers across aluminum pan junctions.

C. Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:
   1. When ground bars are provided at the rear of lineup of bolted together equipment racks, bond the copper ground bars together using solid copper splice plates supplied by the ground bar manufacturer.
   2. Bond together nonadjacent ground bars on equipment racks and cabinets with 6 AWG insulated copper wire bonding jumpers attached at each end with compression-type connectors and mounting bolts.
   3. Provide a 6 AWG bonding jumper between the rack and/or cabinet ground busbar and the aluminum pan of an overhead cable tray or the raised floor stringer as appropriate.

D. Backboards: Provide a screw lug-type terminal block or drilled and tapped copper strip near the top of backboards used for communications cross-connect systems. Connect backboard ground terminals to the aluminum pan in the telephone-type cable tray using an insulated 16 AWG bonding jumper.

E. Bond each conduit interconnecting the TR's and TER's to the ground busbar.

   Other Communication Room Ground Systems: Ground all metallic conduit, wireways, and other metallic equipment located away from equipment racks or cabinets to the cable tray pan or the telecommunications ground busbar, whichever is closer, using insulated 6 AWG ground wire bonding jumpers.

3.16 COMMUNICATIONS CABLE GROUNDING

A. Bond all metallic cable sheaths in multipair communications cables together at each splicing and/or terminating location to provide 100 percent metallic sheath continuity throughout the communications distribution system.
   1. At terminal points, install a cable shield bonding connector provide a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source like the rack or cabinet ground bar.
   2. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is provided as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.

3.17 COMMUNICATIONS CABLE TRAY SYSTEMS

A. Bond the metallic structures of one cable tray in each tray run following the same path to provide 100 percent electrical continuity throughout this cable tray systems as follows:
   1. Splice plates provided by the cable tray manufacturer can be used for providing a ground bonding connection between cable tray sections when the resistance across a bolted connection is 10 milliohms or less. The Contractor shall verify this loss by testing across one slice plate connection in the presence of the Contractor.
   2. Install a 6 AWG bonding jumper across each cable tray splice or junction where splice plates cannot be used.
   3. When cable tray terminations to cable rack, install 6 AWG bonding jumper between cable tray and cable rank pan.

4. Bond cable tray to interconnecting conduit system.

3.18 COMPUTER ROOM GROUNDING

A. Conduit: ground and bond metallic conduit systems as follows:
   1. Ground metallic service conduit and any pipes entering or being routed within the computer room at each end using 6AWG bonding jumpers.
   2. Bond at all intermediate metallic enclosures and across all joints using 6 AWG bonding jumpers.

3.19 WIREWAY GROUNDING

A. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.

B. Install insulated 6 AWG bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 50 feet.

C. Use insulated 6 AWG bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.

D. Use insulated 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 30 feet.

3.20 COMMUNICATION RACEWAY GROUNDING

A. Conduit: Use insulated 6 AWG bonding jumpers to ground metallic conduit at each end and to bond at all intermediate metallic enclosures.

B. Wireway: use insulated 6 AWG bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and across all section junctions.

C. Cable Tray Systems: Use insulated 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 50 feet.

3.21 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below

grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Services at power company interface points shall comply with the power company ground resistance requirements.

D. Below-grade connections shall be visually inspected by the Owner prior to backfilling. The Contractor shall notify the Owner 24 hours before the connections are ready for inspection.

3.22 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth, not less than 10 feet in depth.

B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.23 GROUNDING FOR RF/EMI CONTROL

A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 4 inches wide copper strip or two 10 AWG copper conductors spaced minimum 4 inches apart. Use 6 AWG copper where exposed and subject to damage.

B. Comply with the following when shielded cable is used for data circuits.
   1. Shields shall be continuous throughout each circuit.
   2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
   3. Do not connect shields from different circuits together.
   4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

3.24 FIELD QUALITY CONTROL:

A. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

B. Perform ground resistance testing in accordance with IEEE 142.

C. Perform continuity testing in accordance with IEEE 142.

D. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section Includes:
1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

1.3 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.4 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479, to achieve fire ratings of adjacent construction in accordance with FM, UL, and WH.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.6 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code FM, UL, and WH for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.7 SUBMITTALS

A. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

B. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

E. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.8 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
      a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
   1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 10 years documented experience.

1.10 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.12 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. Electroline Manufacturing Company.
   3. O-Z Gedney Co..

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. B-Line Systems.
   3. Midland Ross Corporation, Electrical Products Division.
   4. Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

A. Sleeves for conduit Through Non-fire Rated Floors: Steel pipe.

B. Sleeves for conduit, bus duct, and cable tray Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

C. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline Link-Seal, Inc.
   2. NMP Corporation.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.5 FIRESTOPPING

A. Manufacturers:
   1. Dow Corning Corp.
   2. Fire Trak Corp.
   3. Hilti Corp.
   4. International Protective Coating Corp.
   5. 3M fire Protection Products.
   6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

   1. Silicone Firestopping Elastomeric Firestopping: Single or Multiple component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Single or Multiple component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral and ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors.

2.6 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
   1. Mineral fiberboard.
   2. Mineral fiber matting.
   3. Sheet metal.
   4. Plywood or particle board.
   5. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish UL listed products or products tested by independent testing laboratory.
   2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
   2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Obtain permission from Design Professional before using powder-actuated anchors.

E. Do not drill or cut structural members.

F. Obtain permission from Design Professional before drilling or cutting structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors, and preset inserts.
   2. Steel Structural Elements: Provide beam clamps, steel ramset fasteners, and welded fasteners.
   3. Concrete Surfaces: Provide expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
   5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
   6. Sheet Metal: Provide sheet metal screws.
   7. Wood Elements: Provide wood screws.

B. Inserts:
   1. Install inserts for placement in concrete forms.
   2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
   1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
   2. Install surface mounted cabinets and panelboards with minimum of four anchors.
   3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
   4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

E. Place intumescent coating in sufficient coats to achieve rating required.

F. Remove dam material after firestopping material has cured.

G. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
   2. Where cable tray, bus, cable bus, conduit, wireway, and trough, penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

H. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.
   2. Install escutcheons, floor plates, and ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
   4. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members and formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 3 inches above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install stainless steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:
1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
3. Section 26 05 34 - Floor Boxes for Electrical Systems.
4. Section 26 05 53 - Identification for Electrical Systems.
5. Section 26 27 16 - Electrical Cabinets and Enclosures.
6. Section 26 27 26 - Wiring Devices.
7. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
8. Section 27 05 36 - Cable Trays for Communications Systems.
9. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.
10. Section 28 05 36 - Cable Trays for Electronic Safety and Security.

1.3 REFERENCES

A. American National Standards Institute:
1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Wiring Methods

1. Interior Wiring

a. Feeders - Electrical Metallic Tubing (EMT).

b. Exposed Branch Circuits - Electrical Metallic Tubing (EMT).

c. Concealed Branch Circuits - Metal Clad Cable (MC).

d. Voice/Data/Video - Electrical Metallic Tubing (EMT).

e. Fire Alarm - Electrical Metallic Tubing (EMT).

f. Building Controls - Electrical Metallic Tubing (EMT).

g. Connection to Vibrating Equipment - Flexible Metallic Conduit (FMC).

h. Connection to Pumps - Liquid-Tight Flexible Metallic Conduit (LFMC).

2. Exterior Wiring Below Grade

a. Feeders – Schedule 40 Non-Metallic Conduit (PVC) encased in concrete ductbank.

b. Branch Circuits – Schedule 80 Non-Metallic Conduit (PVC).

c. Control Circuits – Schedule 80 Non-Metallic Conduit (PVC).

d. PVC transition to above grade/slab - Galvanized Rigid Steel Conduit (GRS).

e. PVC transition to inside building - Galvanized Rigid Steel Conduit (GRS).

f. Link-seals for all conduits entering building horizontally below grade.

3. Exterior Wiring Above Grade

a. Feeders – Rigid Aluminum Conduit (RAC)

b. Branch Circuits – Rigid Aluminum Conduit (RAC)

c. Control Circuits – Rigid Aluminum Conduit (RAC)

d. Connection to Vibrating Equipment - Liquid-Tight Flexible Metallic Conduit (LFMC).

4. Fire Alarm Wiring

a. SLC and NAC – Electrical Metallic Tubing (EMT)

5. Where below grade conduit turns up above grade, finish floor, or foundation wall, the PVC conduit shall be changed to galvanized rigid steel conduit for approximately 6’ below grade to inside building. PVC conduit shall not turn up above finish floor, grade, or through foundation walls.

C. All raceways through walls and floors shall be provided with steel sleeves.

D. All exposed conduits shall be provided with escutcheon plates.

E. Cable Tray – Basket type wire mesh cable tray shall be provided above ceilings for low voltage cable management.

F. All conduits shall be minimum 3/4” in size with threaded or compression fittings.

G. Maximum length of flexible metal conduit will be six feet.

H. All conduits will receive insulated bushings or nylon throats.

I. Separate ground wires will be proved in each raceway.

J. Each branch circuit will be proved with dedicated neutral conductors.

K. Fire rated sleeve assemblies will be provided in all walls and floors for low voltage cabling.

L. Conductor sizes are based on copper unless indicated as aluminum or "AL". When aluminum conductor is substituted for copper conductor, size to match circuit requirements for conductor ampacity and voltage drop.

M. Raceway and boxes are located as indicated on Drawings, and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

N. Raceway Products:

1. Underground: Provide cast metal boxes or nonmetallic handhole.
2. In or Under Slab on Grade: Provide cast or nonmetallic metal boxes.
3. Outdoor Locations, Above Grade: Provide cast metal or nonmetallic outlet, pull, and junction boxes.
4. In Slab Above Grade: Provide metallic tubing and thickwall nonmetallic conduit. Provide cast metal boxes.
5. Wet and Damp Locations: Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
6. Concealed Dry Locations: Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
7. Exposed Dry Locations: Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.5 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.6 SUBMITTALS

A. Product Data: Submit for the following:

1. Flexible metal conduit.
2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Raceway fittings.
5. Conduit bodies.
6. Wireway.
7. Pull and junction boxes.
8. Handholes.

B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents:

1. Record actual routing of conduits larger than 2 inch.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC conduit from sunlight.

1.9 COORDINATION

A. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Rigid Aluminum Conduit: ANSI C80.5.

D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.2 FLEXIBLE METAL CONDUIT

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.

B. Wheatland Tube Company Product Description: Interlocked steel, aluminum construction.

C. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:
1. Carlon Electrical Products.
2. AFC Cable Systems, Inc.
3. Alflex Inc.
4. Allied Tube & Conduit; a Tyco International Ltd. Co.
5. Anamet Electrical, Inc.; Anaconda Metal Hose.
6. Electri-Flex Co.
7. Manhattan/CDT/Cole-Flex.
8. Maverick Tube Corporation.
9. O-Z Gedney; a unit of General Signal.

B. Wheatland Tube Company Product Description: Interlocked aluminum construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.

B. Wheatland Tube Company Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel, compression type.

2.5 NONMETALLIC CONDUIT

A. Manufacturers:
1. Carlon Electrical Products.
2. AFC Cable Systems, Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Arnco Corporation.
5. CANTEX Inc.
6. CertainTeed Corp.; Pipe & Plastics Group.
7. Condux International, Inc.
8. ElecSYS, Inc.
9. Electri-Flex Co.
10. Lamson & Sessions; Carlon Electrical Products.
11. Manhattan/CDT/Cole-Flex.
12. RACO; a Hubbell Company.
13. Thomas & Betts Corporation.

B. Product Description: NEMA TC 2; Schedule 80 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 WIREWAY

A. Manufacturers:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.

5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co., Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Product Description: General purpose type wireway.

C. Knockouts: Manufacturer's standard.

D. Size: One size larger than required by NEC.

E. Cover: Hinged cover.

F. Connector: Slip-in.

G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

H. Finish: Rust inhibiting primer coating with gray enamel finish.

2.7 OUTLET BOXES

A. Manufacturers:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co., Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

C. Nonmetallic Outlet Boxes: NEMA OS 2.

D. Cast Boxes: NEMA FB 1, Type FD, aluminum or cast feralloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

E. Wall Plates for Finished Areas: As specified in Section 26 27 26.

F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.8 PULL AND JUNCTION BOXES

A. Manufacturers:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co., Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 27 16.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
1. Material: Galvanized cast iron or Cast aluminum.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

E. In-Ground Cast Metal Box: NEMA 250, Type 6, inside flanged, recessed cover box for flush mounting:
1. Material: Galvanized cast iron or Cast aluminum.
2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: "ELECTRIC".

F. Concrete composite Handholes: Die-molded, concrete composite hand holes:
1. Conduit Entrance: Field core bored conduit entrance or each side.
2. Cover: Glass-fiber concrete composite. Weatherproof cover with nonskid finish.
3. Provide solid bottoms and gasketed cover.

2.9 SLEEVES

A. Sleeves for Conduit, Cable Tray and Wiring Through Non-fire Rated Floors: Steel pipe.

B. Sleeves for Conduit, Cable Tray and Wiring Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe.

C. Sleeves for Conduit, Cable Tray and Wiring Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

2.10 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline Link-Seal, Inc.
   2. NMP Corporation.
   3. Substitutions: Not Permitted.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.11 FIRE STOPPING

A. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.

B. Foam Firestopping Compounds: Multiple component foam compound.

C. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.

D. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.

E. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.

F. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

G. Firestop Pillows: Formed mineral fiber pillows.

PART 3 EXECUTION

3.1 EXAMINATION

A. The drawings are generally indicative of the work to be performed but do not indicate all bends, fittings, boxes and specialties which may be required or the exact locations affecting all the work. Contractor shall arrange the work accordingly, and furnish such fittings as may be required to meet such conditions at no additional cost to the Owner, and arrange all vertical runs of conduit to clear beams, ductwork, mechanical equipment, and other obstructions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

A. All concealed conduit shall be placed in walls, floors, ceilings, or slabs at the proper time in accordance with the progress of meeting schedules and shall not delay the structural work unnecessarily. Conduits embedded in concrete shall be blocked and braced in place by use of adequate conduit separators to prevent displacement during pouring of the concrete. Where conduit interferes with structural steel, steel reinforcement, or in the opinion of the Engineer occupies too much space in the slab, the conduits shall be rearranged or installed exposed as directed by the Design Professional. No additional payment will be made for such rearrangement of conduit whether or not additional conduit or fittings might be required.

B. Conduit wall seals with water stops shall be installed in outside walls below grade for all incoming or outgoing underground conduit emerging directly into the building area. The conduit wall seals shall have a pressure ring and sealing grommet to ensure a watertight installation.

C. Exposed service entrance conduits and main feeder conduits shall be identified using stenciled letters at intervals not to exceed 20 feet. Size of letters shall be equal to ½ the diameter of the conduit or 2 inches, whichever is less.

D. Conduit joints shall be made up tight using a pipe wrench. Channel lock pliers will not be permitted, and unions shall be used as necessary to aid in the installation. Conduits shall be square and the ends reamed smooth after threading to prevent injury to conductors. Conduit joints in concrete or exposed to weather or damp locations shall be drawn up tight and coated with insulating paint before casting in concrete or painting exposed conduit system.

E. Field bending of polyvinyl chloride conduit shall be made with appropriate equipment. No torches or flame-type device shall be used.

F. When joints are to be made with polyvinyl chloride conduit, the conduit shall be cut with a fine-tooth saw and deburred. Conduit ends shall be wipe clean of dust, dirt, and shavings and shall be dry. A solvent cement shall be applied to bond the joint. The joint should be watertight.

G. Polyvinyl chloride conduit shall be installed in accordance with manufacturer's specifications and recommendations.

H. All underground conduit shall be concrete-encased unless otherwise noted on the drawings or directed by the Engineer. No conduit shall be concealed or encased until the Engineer has reviewed the work for proper installation and accurate placement.

I. The Contractor shall be responsible for all excavating, draining, trenches, forming of duct assembly and protective concrete envelop, backfilling, and removal of excess earth.

J. Underground conduit shall be installed with a minimum 3" per 100 foot downward slope for drainage. Drains shall be provided at all low points.

K. Bends and turns shall be made using long sweeps. Ninety-degree bends will be used only where required and shall be kept at a minimum.

L. All rigid metal conduit risers shall be protected with two coats of a Bitumastic compound before concrete is poured from a point 12" below grade to a point not less than 6" above grade or surface of concrete. All stub-ups shall extend upward with one length of rigid metal conduit until after concrete is poured to assure vertical alignment.

M. All underground conduit runs for voltages less than 600 volts shall be at least 48" below grade and shall have a minimum conduit separation of 3".

N. All underground conduit runs for voltages over 600 volts shall be at least 48" below grade and shall have a minimum conduit separation of 6". Conduit shall have a minimum 6" concrete cover on all sides.

O. All underground conduit runs shall be rodded and a mandrel drawn through followed by a swab to clean out any obstructions which may cause cable abrasions. The mandrel shall be 12" in length and the diameter ½" less than the inside diameter of the conduit.

P. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system. Arrange raceway supports to prevent misalignment during wiring installation. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

B. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

C. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

D. Do not attach raceway to ceiling support wires or other piping systems.

E. Construct wireway supports from steel channel specified in Section 26 05 29.

F. Route conduit in and under slab from point-to-point.

G. Maximum Size Conduit in Slab Above Grade: 3/4 inch. Do not cross conduits in slab.

H. Cut conduit square using saw or pipe cutter; de-burr cut ends. Bring conduit to shoulder of fittings; fasten securely.

I. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

J. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

K. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate bends in metal conduit larger than 2 inch size.

L. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

M. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

N. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

O. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

P. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

Q. Close ends and unused openings in wireway.

R. Conceal all conduit unless indicated otherwise, within finished walls, ceilings, floors, and existing construction. Keep raceways at least twelve inches away from parallel runs of flues, steam, and hot water pipes. Install raceways level and square and at proper elevations.

S. Elevation of Raceway: Where possible, install horizontal raceway runs above all piping, and mechanical ducts tight to ceiling.

T. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

U. Install all raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. Run exposed, parallel, or banked raceways together.

V. Communication System Raceways 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways 2-inch and smaller trade size in maximum lengths at 100 feet and with a maximum of two 90 deg. bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

W. All conduits shall be securely supported by individual ring hangers and rods, steel trapeze hangers or galvanized malleable iron pipes fastened to concrete slabs, beams or bar joists or from beam clamps attached to the structural members of the building.

X. The arrangement of all conduits and the methods of fastening same shall be subject to the direction and approval of the Engineer and Architect. Power and branch circuit conduits shall be installed so that not more than the equivalent of three 90 degree bends occur in any one run. If a greater number of bends is required, a junction box shall be installed.

Y. Raceways, boxes, etc. above suspended ceiling shall be supported directly from structure, independent of ceiling system, duct, piping, or other work.

Z. All metal conduit enclosures and raceways for conductors shall be mechanically joined to form a continuous electrical conductor, and shall be so connected to all electrical boxes, fittings, and cabinets as to provide effective electrical continuity and firm mechanical assembly.

3.5 INSTALLATION - BOXES

A. Outlet boxes to be furnished and installed by this Contractor shall consist of the various types of outlet boxes required for wiring devices, lighting fixtures and all other equipment as required for the electrical work. The extent of the outlet boxes shall be as shown on the drawing and as required. Boxes shall be manufactured by Steel City or approved equal.

B. The exact location of outlets shall be obtained from the drawings of interior details and finishes. In locating outlets, caution shall be taken to allow for overhead pipes, ducts, variations in arrangement, thickness of finish window trim, paneling, door swings, and other architectural construction. All lighting fixture outlets shall be located symmetrically within areas. Any inaccuracy in locating outlets shall be corrected without additional expense to the Owner. Any condition that would place an outlet box in an unsuitable location, such as a molding or break in wall finish shall be referred to the Architect for a more desirable location. All outlet boxes shall

be securely fastened. Exposed outlet boxes shall be attached to permanent inserts or lead anchors with machine screws. All unused openings in outlet boxes shall be closed with knockout closers manufactured for that purpose.

C. Blank plates shall be installed on the outlet boxes on which no apparatus is installed, or if the apparatus installed does not provide a suitable cover for box.

D. Contractor shall submit a schedule of installation heights for coordination and approval by the Design Professional prior to final roughing-in.

E. Contractor shall be responsible that locations of outlets do not interfere with mechanical construction or architectural features.

F. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings and as specified in section for outlet device.

G. Adjust box location up to 10 feet prior to rough-in to accommodate

H. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

I. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

J. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

K. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

L. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

M. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

N. Install stamped steel bridges to fasten flush mounting outlet box between studs.

O. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

P. Install adjustable steel channel fasteners for hung ceiling outlet box.

Q. Do not fasten boxes to ceiling support wires or other piping systems.

R. Support boxes independently of conduit.

S. Install gang box where more than one device is mounted together. Do not use sectional box.

T. Install gang box with plaster ring for single device outlets.

3.6 STUB-UP CONNECTIONS

A. Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor.

3.7 FLEXIBLE CONNECTIONS

A. Use short length of flexible conduit for equipment subject to vibration, noise transmission or movement; and for all motors, transformers, dimmer panels/racks, and light fixtures. Use liquidtight flexible conduit in wet locations, inside air handling units, and all pump motors. Install separate ground conductor across flexible connections.

3.8 FITTINGS

1. All couplings and fittings for EMT shall be steel, contain nylon insulated throats and shall be raintight – either the gland and ring compression type or the stainless steel multiple point locking type, as manufactured by Thomas & Betts or approved equal. Fittings using sets of screws or indentations as a means of attachment will not be permitted.
2. Locknuts, bushings and other fittings for standard rigid conduit shall be made of steel or malleable iron; changes in direction or runs shall be made with symmetrical bends of cast metal fittings as manufactured by Crouse-Hinds or approved equal.
3. Raceways crossing expansion joints shall be provided with suitable expansion fittings.
4. Where rigid conduit is installed in a cabinet, junction box, pull box, or auxiliary gutter, the conductors shall be protected by a nylon insulated metallic bushings as manufactured by Thomas & Betts or approved equal. Locknut shall be installed outside the enclosure. Conduit bushings 1 ½” and larger shall be provided with a copper grounding lug with pressure type wire terminal.

3.9 INSTALLATION OF CONCEALED CONDUIT

1. Conduit work shall be concealed in all finished portions of the building. Where conduits are to be imbedded in concrete, they shall be placed so as not to interfere with the proper placement of the reinforcing bars.
2. Conduit shall be installed so as not to damage structural members. The approval of the Design Professional will be required to run conduit through columns, beams, or structural members.
3. Horizontal or crossruns in building-type partitions or side walls shall be avoided. All conduit to outlets in building-type partitions shall be run down from ceiling or up from slab into the partition. Conduit shall be run in the slab parallel to the partition, a minimum of 6” before making turn-up.

3.10 INSTALLATION OF EXPOSED RACEWAYS

1. Exposed, raceways, where permitted, and extensions from concealed conduit shall be neatly run, parallel with or at tight angles to the walls of the building. Where connection to overhead exposed raceways are required to be run down walls, vertical run of conduit shall be concealed within the new or existing wall to switchlegs, receptacles, panelboards, etc.
2. Exposed raceways shall be supported from ceilings or walls approved hangers, ceiling trapeze, clamps or clips fastened by machine screws to expansion sleeves, inserts or lead anchors. Conduit shall be supported on each side of bends. Spacing of clamps of hangers for supporting conduit from ceiling or walls shall not be greater than 5’ apart.

3. Connections to motor terminal boxes shall be made by the use of flexible steel conduit not to exceed 18” in length, and shall be of the same size as the conduit to which it connects, grounded per N.E.C. requirements.

3.11 GROUDING

1. Electrically ground raceways and ensure continuous electrical conductivity.

3.12 SLEEVES

1. Exterior watertight entries: Seal with mechanical sleeve seal.
2. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
3. Install sleeves where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight.

3.13 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in Section.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.14 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.15 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 09 23

LIGHTING AND BRANCH CIRCUIT CONTROL DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section Includes:
1. Occupancy sensors.
2. Power pack relays.

1.3 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contractors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
5. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
6. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
7. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

1.4 SYSTEM DESCRIPTION

A. Where indicated on drawings or required by applicable code, provide automatic shutoff for lighting inside building larger than 5000 square feet. Control shutoff by method conforming to ICC IECC.

B. Where indicated on drawings or required by applicable code, provide automatic shutoff for lighting outside building. Control shutoff by method conforming to ICC IECC.

1.5 SUBMITTALS

A. Shop Drawings: Indicate dimensioned drawings of control system components and accessories.

1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches or devices.
2. Include typical wiring diagrams for each component.
3. Provide AutoCAD drawing of the facility showing coverage patterns and technical data.

B. Product Data: Submit manufacturer’s standard product data for each system component.

C. Manufacturer's Installation Instructions: Submit for each system component.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record the following information:

1. Actual locations of components and record circuiting and switching arrangements.
2. Wiring diagrams reflecting field installed conditions with identified and numbered, system components and devices.

B. Operation and Maintenance Data:

1. Submit replacement parts numbers.
2. Submit manufacturer’s published installation instructions and operating instructions.
3. Recommended renewal parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Accept components on site in manufacturer’s packaging. Inspect for damage.

B. Protect components by storing in manufacturer’s containers indoor protected from weather.

1.10 WARRANTY

A. Furnish five year manufacturer warranty for components.

1.11 EXTRA MATERIALS

A. Furnish five of each switch type.

B. Furnish five of each occupancy sensor type.

C. Furnish five of each photocell type.

1.12 OCCUPANCY DETECTION TECHNOLOGY REQUIREMENTS

A. The occupancy sensor system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

B. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.

C. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.

D. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Ultrasonic which both looks for occupant motion and listens for sounds indicating occupants.

1.13 OCCUPANCY SENSOR OPERATION REQUIREMENTS

A. Sensors shall offer a minimum on timer of at least 15 minutes, in order to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time period. This timer shall be in addition to the regular occupancy time delay that keeps lights on after last detected occupancy. User shall be able to disable/enable and change the value of this timer.

B. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 10 minutes. Sensors with a longer factory default setting shall not be permitted as they greatly restrict energy savings potential.

C. Manual adjustment to the occupancy time delay so as to increase it shall be accommodated, but shall not be allowed unless a calculation showing the resulting energy savings loss is presented to the building owner and specifying engineer.

D. Automatic adjustments to the occupancy time delay shall only be permitted if the controlling algorithm maximizes both lamp life and energy savings. For example a shorter more energy saving time delay setting shall only be allowed if the resulting lamp life is also improved.

E. Installer, in accordance with manufacturer’s recommendation, shall determine final sensor location. All sensors shall be factory calibrated for optimum performance for its installed PIR lens, and shall not require initial or subsequent field adjustment of detection sensitivity.

F. All sensor setting adjustments shall be digital and made using a push-button. Dip switches, analog dials, and/or the need for tools of any kind shall not be accepted.

G. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.14 MISCELLANEOUS REQUIREMENTS

A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing. Manufacturing facility must be ROHS compliant.

B. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

C. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

D. Sensors shall have a 5 year warranty.

1.15 APPROVED MANUFACTURER AND SUBSTITUTIONS

A. Approved manufacturer's:

1. Sensor Switch
2. Wattstopper
3. Hubbell
4. Leviton
5. Lutron

PART 2 PRODUCTS

2.1 WALL SWITCH OCCUPANCY SENSORS – SMALL AREAS

A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 20 ft (6.10 m).

B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Ultrasonic) detection shall be used.

C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.

D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. A version capable of switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.

E. Sensor shall recess into single gang switch box and fit a standard GFI opening.

F. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.

G. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.

H. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology (only exception is versions with lighted push-buttons).

I. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected in order to function.

J. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, low temperature/high humidity operation.

K. All sensor settings, including time delay and photocell settings shall be digital and accessible for adjustment via a push-button without requiring removal of cover plate or tools of any kind.

L. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point as applicable.

M. All models shall be capable of both Auto-On and Manual On operation.

N. All models shall be capable of a “Reduced Turn On” operation where the initial PIR turn on level is higher in order to eliminate PIR from reflective surfaces from being detected. PIR shall be returned to normal levels upon initial PIR detection.

O. All models shall have a “Predictive Off” mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.

P. All models shall be capable of disabling override switch.

2.2 WALL SWITCH OCCUPANCY SENSORS – LARGE AREAS

A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 40 ft (12.19 m).

B. In areas with periodic or permanent obstruction to a sensor’s field of view, sensors that utilize dual technology (PIR/Ultrasonic) detection shall be used.

C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.

D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz. A version capable of switching 347 VAC shall also be available. Load ratings shall be 13A each pole, ¼ HP motor load.

E. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.

F. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.

G. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology.

H. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (Off) condition. Sensor shall not require a minimum load to be connected in order to function.

2.3 LOW VOLTAGE OCCUPANCY SENSOR

A. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.

B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Ultrasonic) detection shall be used.

C. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.

D. Sensors shall interconnect with other sensors and power/relay packs with class 2, three-conductor wire.

E. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 mA so that up to 14 sensors may be connected to a single power pack.

F. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.

G. Each designated zone shall contain one sensor with a SPDT class 2 auxiliary relay, providing an input to building automation system (BAS). All sensors in designated zone shall communicate to sensor with relay for status to BAS. Sensor relay coil shall energize in the unoccupied state to load share the low voltage current from power pack. Note that power pack must be installed on the Line side of the local toggle switch for auxiliary relay to work properly.

H. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.

I. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.

2.4 POWER PACKS

A. Power packs shall accept and switch 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.

B. Power pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

C. When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

D. Power pack shall incorporate a Class 1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20 Amp switching of all load types, and be rated for 400,000 cycles.

E. Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.

2.5 LINE VOLTAGE OCCUPANCY SENSORS

A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.

B. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer’s best practice recommendations.

C. In areas with periodic or permanent obstruction to a sensor’s field of view, sensors that utilize dual technology (PIR/Ultrasonic) detection shall be used.

D. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.

E. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.

F. Multiple sensors controlling the same load shall be wired in parallel.

G. For applications requiring independent control of two loads, a sensor with two dual relays shall be required. Each relay shall have independent programmable occupancy time delays.

H. Dual relay sensors shall have an optional operational mode called “Alternating On” where when during unoccupied periods, one relay is always left closed (thus one load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.

I. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. A version capable of switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.

J. Specific sensors capable of switching 5 Amps of two phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.

K. Wall mounted sensors must be installed at 7 to 8 feet above the floor. Single and two circuit units shall be available.

L. High bay sensors controlling HID Bi-Level must incorporate a “Start to High” timer on initial power up to provide full light output for up to 20 minutes to prevent shortened lamp life.

M. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.

N. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.

PART 3 EXECUTION

3.1 INSTALLATION

A. Mount switches, occupancy sensors, and photocells as indicated on Drawings, and as recommended by the manufacturer.

B. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings. Install wire in conduit.

3.2 MANUFACTURER'S FIELD SERVICES

A. Furnish services for minimum of three days for check, test, and start-up.

3.3 ADJUSTING

A. Test each system component after installation to verify proper operation.

B. Test relays, contactors, and switches after installation to confirm proper operation.

C. Confirm correct loads are recorded on directory card in each panel.

3.4 DEMONSTRATION

A. Demonstrate operation of the following system components:

1. Operation of switches. Demonstrate for all zones.
2. Operation of each type of occupancy sensor. Demonstrate for all zones.
3. Operation of type of photocell. Demonstrate for all zones.

B. Furnish 4 hours to instruct Owner's personnel in operation and maintenance of system. Schedule training with Owner, provide at least 14 days notice to Design Professional of training date.

END OF SECTION

SECTION 26 09 43

EXPANSION OF LUTRON QUANTUM LIGHTING CONTROLS

PART 1- GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section Includes:
1. Expansion of the existing High School Building Lutron Digital-Network Lighting Control System.
2. Provide networked interface back to the existing system either through Lutron dedicated network or through the building's information technology infrastructure.
3. Provide all required modifications to the existing system to monitor and control the new lighting control system components.
4. Provide all required Quantum hubs to communicate back to the existing system.

1.3 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE).
1. C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. ASTM International (ASTM)
1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.
2. G21-96 (2002) - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
3. G22-76 (1996) - Standard Practice for Determining Resistance of Plastics to Bacteria.

C. Canadian Standards Association (CSA)
1. CSA C22.2 # 14 Industrial Control Equipment
2. CSA C22.2 # 184 Solid-State Lighting Controls
3. CSA C22.2 # 156 Solid-State Speed Controls
4. CSA C22.2 # 42.1-00 Cover Plates for Flush Mounted Wiring Devices
5. CSA C22.2 # 42-99 General Use Receptacles

6. CSA C22.2 #. 74 – Electronic Ballast Standard
7. CSA 22.2 # 223 - Power Supplies with Extra-Low-Voltage Class 2 Outputs.

D. International Electrotechnical Commission
1. (IEC) 801-2 Electrostatic Discharge Testing Standard.
2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.
3. IEC/EN 55014-1 (2000) - Emission Test for Electrical Motor-Operated and Thermal Appliances for Household and Similar Purposes, Electrical Tools and Similar Electrical Apparatus.
4. IEC/EN 61000-3-2 (2000) - Limits for Harmonic Currents Emissions.
5. IEC/EN 61000-3-3 (1995) - Limitation of Voltage Fluctuations and Flicker.
6. IEC/EN 55014-2 (1997) - Immunity Test for Household Appliances Electrical Tools and Similar Electrical Appliances.
7. IEC/EN 60335-1 (2004) - Household and Similar Electrical Appliances - General Requirements.
8. IEC/EN 60335-2-97 (2002) - Household and Similar Electrical Appliances - Particular Requirements for Drives for Roller Shutters, Awnings, Blinds, and Similar Equipment.

E. International Organization for Standardization (ISO):
1. 9001:2000 – Quality Management Systems.

F. National Electrical Manufacturers Association (NEMA)
1. WD1 (R2005) - General Color Requirements for Wiring Devices.
2. WD6 – Dimensional Specifications.
3. Ballast standards

G. Underwriters Laboratories, Inc. (UL):
1. 94 – Flammability Rating
2. 489 (2002) - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
3. UL498 – Standard for Attachment Plugs and Receptacles.
4. 508 (1999) - Standard for Industrial Control Equipment.
5. UL514C – Standard for Non-metallic Outlet Boxes, Flush Device Boxes, and Covers.
6. 916 – Energy Management Equipment.
7. 924 (2003) - Emergency Lighting and Power Equipment
8. 935 (2005) - Fluorescent Ballasts
9. 1310 – Class 2 Power Units.
10. 1472 (1996) - Solid-State Dimming Controls.

H. National Fire Protection Association (NFPA) 701 (2004) - Standard Methods of Fire Tests for Flame Propagation.

1.4 SYSTEM DESCRIPTION

A. Quantum includes computer-based software that provides control, configuration, monitoring and reports. System includes:
   1. Lighting Management Panel.
   2. Quantum Manager - light management computer and software.
   3. Power interfaces and power modules.
   4. Low voltage wall stations and control interfaces and sensors.

1.5 SUBMITTALS

A. Specification Conformance Document: Indicate whether the submitted equipment:
   1. Meets specification exactly as stated.
   2. Meets specification via an alternate means and indicate the specific methodology used.

B. Shop Drawings; include:
   1. Schematic (one-line diagram) of system.
   2. Mounting dimension requirements for each product and mounting condition.

C. Samples:
   1. Samples showing available color and finish selections for controls.

D. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

E. Sequence of Operation to describe how each area operates and how any building wide functionality is described.

F. Quality Control Submittals:
   1. Test Reports: Indicating compliance with specified fabric properties.
   2. Certification: Morton International Laboratory Report for PVC coated fabrics and bacterial and mildew resistance.

1.6 CLOSEOUT SUBMITTALS

A. Sustainable Design Closeout Documentation
   1. Lighting Control System Manufacturer to provide Enhanced Start-up documentation that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.

1.7 QUALITY ASSURANCE

A. Lighting control system components:
   1. Listed by UL specifically for the required loads. Provide evidence of compliance upon request.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Include installation, programming, and maintenance instructions.

1.9 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature:
      a. Lighting Control System: 0 degrees to 40 degrees C (32 degrees to 104 degrees F).
   2. Relative humidity: Maximum 90 percent, non-condensing.
   3. Lighting control system must be protected from dust during installation.

B. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 COORDINATION

A. Coordinate pre-wiring of system utilizing manufacturer’s approved low voltage wiring to each device/equipment location.

1.11 WARRANTY

A. Provide Manufacturer’s 8 Year Limited Parts Warranty and 2 Year Labor Coverage :

1.12 MAINTENANCE MATERIAL SUBMITTALS

A. Make ordering of new equipment for expansions, replacements, and spare parts available to end-user, qualified dealer or installer.

B. Make new replacement parts available for minimum of 10 years from date of manufacture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Lutron Electronics Co., Inc. – System: Lutron Quantum

2.2 GENERAL

A. Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.

B. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.

2.3 RELAY PERFORMANCE REQUIREMENTS

A. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of relay.

B. Design and test relays to withstand line-side surges without impairment to performance.

1. Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41 and per IEC 61000-4-5 surge requirements.
2. Other power handling devices: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41.

C. Power failure memory relay recovery:
1. When power is interrupted and subsequently returned, within 3 seconds lights will automatically return to same levels prior to power interruption.

D. Non-dim circuits to meet the following requirements:
1. Rated life of relay at full load: Minimum 1,000,000 cycles.
2. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.

2.4 ENERGI SAVR NODE LIGHTING CONTROL MODULE

A. Softswitch Switching Lighting Control Module:
1. Product: QSN
2. Mechanical:
   a. Listed to UL 508 (United States) as industrial control equipment. CSA (Canada) certified, or NOM (Mexico) approved as applicable.
   b. Delivered and installed as a [UL] [CSA] listed factory assembled panel.
   c. Panels passively cooled via free-convection, unaided by fans or other means.
3. Surface mounted
4. Switching:
   a. Rated life of relay: Minimum 1,000,000 cycles.
   b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
   c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
   d. Module to integrate up to 4 individually controlled zones, each with a capacity of up to 16 amps, of high in-rush lighting load (magnetic fluorescent ballast, electronic fluorescent ballast, incandescent, magnetic low-voltage, electronic low-voltage, neon/cold cathode and motor loads).
   e. Utilize air gap off – activated when user selects “off” at any control to disconnect the load from line supply.
5. Connection without interface to wired:
   a. Occupancy sensors
   b. Daylight sensors
   c. IR receivers for personal control
6. Capable of being controlled via wireless sensors and controls
7. Connects to Lighting Management Panel via RS485.
8. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
9. Contact Closure Input
   a. Directly accept contact closure input from a dry contact closure or solid-state output without interface to:

1) Activate scenes
   a) Scene activation from momentary or maintained closure
2) Enable or disable afterhours
   a) Automatic sweep to user-specified level after user-specified time has elapsed
   b) System will provide occupants a visual warning prior to sweeping lights to user-specified level
   c) Occupant can reset timeout by pressing a button on a control station
3) Activate or deactivate demand response (load shed)
   a) Load shed event will reduce lighting load by user-specified amount

10. Emergency Contact Closure Input
    a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 Listed Emergency Lighting Interface, security system or fire alarm system
    b. Allow configurable zone response during emergency state.
    c. Disable control operation until emergency signal is cleared.

2.5 LIGHTING MANAGEMENT PANEL

A. Provide Lighting Management Panel in a pre-assembled NEMA listed enclosure with terminal blocks listed for field wiring.

B. Enables Q-Admin Light Management software to control and monitor EcoSystem dimming ballast, EcoSystem modules, Power Panels, GRAFIK Eye QS, and Sivoia QS window treatments.
   1. Lighting Management Panel utilizes Ethernet connectivity to Q-Manager.
      a. Dedicated Network Environment is used to connect Q-Manager with Lighting Management Panels.

C. Integrate control station devices, power panels, shades, preset lighting controls, and external inputs into single customizable, multiple failsafe lighting control system, operable manually, automatically or through computer control.

D. Astronomical time clock.

E. Solar clock to track the position of the sun to control the shades to limit penetration of direct sunlight.

F. Maintains a backup of the programming in a non-volatile memory capable of lasting more than ten years without power.

G. BACnet Integration License for Lights
   1. Provide ability to communicate by means of BACnet IP communication to Lutron Quantum system from a user-supplied 10BASE-T or 100BASE-T Ethernet network.
   2. Lighting Management Panel shall have embedded BACnet stack. Lighting Control Systems requiring BACnet gateway to Energy Management System (EMS) or Building Management System (BMS) shall not be acceptable.
   3. Each Lighting Management Panel processor requires license for BACnet integration.
   4. Basic BACnet integration license for lights
      a. The BACnet integrator can command:
         1) Area light output

2) Area enable or disable afterhours mode
3) Area load shed level
4) Area load shed enable/disable

b. The BACnet integrator can monitor:
1) Area on/off status
2) Area occupancy status
3) Area fault
4) Area load shed status

2.6 POWER PANELS

A. Product: Lutron XP Series relay panels.

B. Mechanical:
1. Typically, electrical inspection is required for equipment installed in commercial buildings. Most inspectors will require a UL listing of products. The following statement ensures proper compliance for commercial applications.
2. Listed to UL 508 as industrial control equipment. CSA certified, or NOM approved as applicable.
3. To acquire UL or CSA listing on field assembled panels, a UL/CSA inspector must test the installed equipment on site. This will add costs to the project and could result in delays. Factory assembled panels are fully tested and UL/CSA listed when delivered to the site. These pre-assembled panels can be quickly installed and eliminate potential assembly errors in the field, saving installation costs.
4. Edit paragraph below retaining only those standards necessary to meet project requirements.
5. Delivered and installed as a [UL] [CSA] listed factory assembled panel.
6. If you remove components of the panel and reassemble it in the field, the UL listing is voided. To regain the UL listing the field assembled panel must be re-inspected by a UL inspector. The benefits of having the equipment pre-tested at the factory are lost. The following statement ensures panel integrity.
7. Field wiring accessible from front of panel without need to remove dimmer assemblies or other components.
8. Systems requiring forced air fan cooling require ongoing maintenance and increased energy usage for the life of the system. Natural convection eliminates this need and provides maintenance free cooling. The following statement ensures maintenance-free cooling of panels. If dimming panels are mechanically cooled, consider requiring the contractor to include a service contract to provide inspection and maintenance service on a semi-annual basis over the life of the equipment.
9. Panels passively cooled via free-convection, unaided by fans or other means.
10. Typically mis-wires and load shorts occur during initial startup. To prevent any damage to the equipment, jumpers need to be in place during startup. An additional benefit is that jumpers can be re-inserted to provide lighting in spaces in the unlikely event of a dimmer failure.
11. Ship panels with each dimmer in mechanical bypass position by means of jumper bar inserted between input and load terminals. Jumpers to carry full rated load current and be reusable at any time. Mechanical bypass device to allow for switching operation of connected load with dimmer removed by means of circuit breaker.

12. Utilize air gap off to disconnect the load from line supply.

2.7 LOW-VOLTAGE WALL STATIONS

A. System Wall Stations
1. Allows controls of any devices part of the Lutron System.
2. Product: Preset Lighting Controls with Zone Override.
3. Electronics:
   a. Use RS485 wiring for low voltage communication.
4. Functionality:
   a. Upon button press, LEDs to immediately illuminate.
   b. LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or the LEDs turn off if the button press was not processed.
   c. Allow for easy reprogramming without replacing unit.
   d. Replacement of units does not require reprogramming.
5. Color:
   a. Custom color to be selected.
   b. Color variation in same product family: Maximum ΔE=1, CIE L*a*b color units.
   c. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.
6. Provide faceplates with concealed mounting hardware.
7. Engrave wall stations in English with appropriate button, zone, and scene engraving descriptions.
8. Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.
9. Software Configuration:
   a. Customizable control station device button functionality:
      1) Buttons can be programmed to perform single defined action.
      2) Buttons can be programmed to perform defined action on press and defined action on release.
10. Control station device LEDs to support logic that defines when it is illuminated:
    a. Scene logic (logic is true when all zones are at defined levels).
    b. Room logic (logic is true when at least one zone is on).
    c. Pathway (logic is true when at least one zone is on).
    d. Last scene (logic is true when spaces are in defined scenes).

2.8 ACCESSORIES

A. Emergency Lighting Interface; Lutron LUT-ELI
1. Provides total system listing to UL924 when used with Lutron Quantum system.
2. Senses all three phases of building power.
3. Provides an output to power panels or Digital Ballast Interfaces if power on any phase fails and sends all lights controlled by these devices to [an emergency light level setting] [100 percent intensity]. Lights to return to their previous intensities when normal power is restored.
4. Accepts a contact closure input from a fire alarm control panel.

2.9 WIRING DEVICE ACCESSORIES

A. Wall Plates
1. Listed to UL 514C, CSA C22.2 #42.1-00
2. Provide an adapter plate for proper device alignment and wall plate attachment.
3. Product: Architectural style face plates: Vareo.

2.10 SOURCE QUALITY CONTROL

A. Perform full-function testing on all completed assemblies at end of line. Statistical sampling is not acceptable.

B. Perform full-function testing on 100 percent of all ballasts at the factory.

C. Audit burn-in at 40 degrees C (104 degrees F) ambient temperature of dimming assemblies and panels at full load for two hours.

D. Perform burn-in at 40 degrees C (104 degrees F) ambient temperature on 100 percent of all ballasts at the factory.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer’s installation instructions.

B. Provide complete installation of system in accordance with Contract Documents.

C. Provide dedicated network between Q-Manager computer and Quantum Lighting Management Panels.

D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

E. Define each relay’s load type, assign each load to a zone, and set control functions.

F. Mount exterior daylight sensors to point due north with constant view of daylight.

G. Systems Integration:
1. Contractor to coordinate meeting between Facility Representative, Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures.

3.2 SERVICE AND SUPPORT

A. Startup and Programming
1. Provide factory certified field service engineer to make minimum of six site visits to ensure proper system installation and operation under following parameters
a. Qualifications for factory certified field service engineer:

1) Minimum experience of 2 years training in the electrical/electronic field.
2) Certified by the equipment manufacturer on the system installed.

b. Make first visit prior to installation of wiring. Review:
1) Low voltage wiring requirements.
2) Separation of power and low voltage/data wiring.
3) Wire labeling.
4) Lighting Management Panel locations and installations.
5) Control locations.
6) Computer jack locations.
7) Load circuit wiring.
8) Network wiring requirements.
9) Connections to other equipment and other Lutron equipment.
10) Installer responsibilities.
11) Power Panel locations.

c. Make second visit upon completion of installation of Network Lighting Control System:
1) Verify connection of power wiring and load circuits.
2) Verify connection and location of controls.
3) Energize Lighting Management Panels and download system data program.
4) Address devices.
5) Verify proper connection of panel links (low voltage/data) and address panel.
6) Download system panel data to dimming/switching panels
7) Check dimming panel load types and currents and supervise removal of by-pass jumpers.
8) Verify system operation control by control.
9) Verify proper operation of manufacturers interfacing equipment.
10) Verify proper operation of manufacturers supplied PC and installed programs.
11) Configure initial groupings of ballast for wall controls, daylight sensors and occupant sensors.
12) Initial calibration of sensors.
13) Obtain sign-off on system functions.

d. Make third visit to demonstrate and educate Owner's representative on system capabilities, operation and maintenance.

e. Remaining visits to be scheduled as required for the troubleshooting.

2. Startup
a. Q-Admin configuration
1) Naming and association of areas and lighting zones.

B. Training of customer representatives for Q-Admin.
1. Configuration Software used to make system programming and configuration changes
2. Control and Monitor
3. Green Glance

C. Tech Support
1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

3.3 FIELD QUALITY CONTROL

A. Manufacturer Services
   1. Aim and Focus Visit
      a. Contractor to coordinate on-site meeting with Lighting Control System Manufacturer and Lighting Design Consultant to make required lighting adjustments to the system for conformance with the Lighting Design Consultant's original design intent.

3.4 CLOSEOUT ACTIVITIES

A. Training Visit
   1. Lighting Control System Manufacturer to provide 1 day additional on-site system training to site personnel.

B. On-site Walkthrough
   1. Lighting Control System Manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance of control system to Owner.

3.6 MAINTENANCE

A. Capable of providing on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup.

C. System Optimization Visit
   1. Lighting Control System Manufacturer to visit site 6 months and 12 months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.

END OF SECTION

SECTION 26 11 18

OUTDOOR SWITCHGEAR

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 GENERAL

A. The pad-mounted gear shall be in accordance with the single-line diagram, and shall conform to the following specification.

B. The pad-mounted gear shall consist of a single self-supporting enclosure, containing interrupter switches and power fuses with the necessary accessory components, all completely factory-assembled and operationally checked. The interrupter switches and fuses shall be enclosed within an inner grounded steel compartment for electrical isolation and for protection from contamination. Switch terminals shall be equipped with bushings rated 600 amperes continuous, and fuse terminals and bus terminals shall be equipped with bushing wells rated 200 amperes continuous to provide for elbow connection. Bushings and bushing wells shall be mounted on the walls of the inner compartment and shall extend into termination compartments. A termination compartment shall be provided for each three-phase switch, each three-phase set of fuses, and each three-phase set of bus terminals.

C. Ratings

The ratings for the integrated pad-mounted gear shall be as designated below.
Nominal Voltage, kV: 14.4
Maximum Voltage, kV: 17.0
BIL Voltage, kV: 95
Short-Circuit
Peak Withstand Current, Amperes, Peak: 32,500
One-Second Short-Time Withstand Current, Amperes, RMS, Symmetrical: 12,500
MVA, Three-Phase Symmetrical, at Rated Nominal Voltage: 310
Main Bus
Continuous Current, Amperes: 600
Peak Withstand Current, Amperes, Peak: 65,000
One-Second Short-Time Withstand Current, Amperes, RMS, Symmetrical: 25,000

Three-Pole Interrupter Switches
Continuous Current, Amperes: 600
Load Dropping Current, Amperes: 600
Peak Withstand Current, Amperes, Peak: 65,000
One-Second Short-Time Withstand Current, Amperes, RMS, Symmetrical: 14,000
Three-Time Duty-Cycle Fault-Closing Current, Amperes, Peak: 36,400
Fuses
Maximum Current, Amperes: 200E

D. The short-circuit and three-time duty-cycle fault-closing ratings of switches, short-circuit rating of bus, and interrupting ratings of fuses shall equal or exceed the short-circuit ratings of the pad-mounted gear.

1.3 CERTIFICATION OF RATINGS

A. The manufacturer of the pad-mounted gear shall be completely and solely responsible for the performance of the basic switch and fuse components as well as the complete integrated assembly as rated.

B. The manufacturer shall furnish, upon request, certification of ratings of the basic switch and fuse components and/or the integrated pad-mounted gear assembly consisting of the switch and fuse components in combination with the enclosure.

1.4 COMPLIANCE WITH STANDARDS AND CODES

A. The pad-mounted gear shall conform to or exceed the applicable requirements of the following standards and codes:

1. All portions of ANSI C57.12.28, covering enclosure integrity for pad-mounted equipment.
2. Article 710.21(e) in the National Electrical Code, which specifies that the interrupter switches in combination with power fuses shall safely withstand the effects of closing, carrying, and interrupting all possible currents up to the assigned maximum short-circuit rating.
3. All portions of ANSI, IEEE, and NEMA standards applicable to the basic switch and fuse components.
4. UL Listing.

1.5 ENCLOSURE DESIGN

A. To ensure a completely coordinated design, the pad-mounted gear shall be constructed in accordance with the minimum construction specifications of the fuse and/or switch manufacturer to provide adequate electrical clearances.

B. In establishing the requirements for the enclosure design, consideration shall be given to all relevant factors such as controlled access, tamper resistance, corrosion resistance, and resistance to entry of foliage, animals, and airborne contaminants.

PART 2 CONSTRUCTION

2.1 INSULATORS

A. The interrupter-switch and fuse-mounting insulators shall be of a cycloaliphatic epoxy resin system with characteristics and restrictions as follows:

1. Operating experience of at least 25 years under similar conditions.
2. Adequate leakage distance established by test per IEC Publication 507, “Artificial Pollution Test on High Voltage Insulators to be Used on AC Systems.”
3. Adequate strength for short-circuit stress established by test.
4. Conformance with applicable ANSI standards.
5. Homogeneity of the cycloaliphatic epoxy resin throughout each insulator to provide maximum resistance to power arcs. Ablation due to high temperatures from power arcs shall continuously expose more material of the same composition and properties so that no change in mechanical or electrical characteristics takes place because of arc-induced ablation. Furthermore, any surface damage to insulators during installation or maintenance of the pad-mounted gear shall expose material of the same composition and properties so that insulators with minor surface damage need not be replaced.

2.2 HIGH-VOLTAGE BUS

A. Bus and interconnections shall consist of aluminum bar of 56% IACS conductivity.

B. Bus and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating of the pad-mounted gear.

C. Bolted aluminum-to-aluminum connections shall be made with a suitable number of galvanized steel bolts, with two Belleville spring washers per bolt, one under the bolt head and one under the nut. Bolts shall be tightened to 50 foot-pounds torque.

D. Before installation of the bus, all electrical contact surfaces shall first be prepared by machine-abrading to remove any aluminum-oxide film. Immediately after this operation, the electrical contact surfaces shall be coated with a uniform coating of an oxide inhibitor and sealant.

E. Tie bus, where furnished, shall consist of continuous, one-piece sections of aluminum bar with no intermediate splices. Flexible braid or cable shall not be used.

2.3 PROVISIONS FOR GROUNDING

A. A ground-connection pad shall be provided in each termination compartment of the pad-mounted gear.

B. The ground-connection pad shall be constructed of no less than 3/8 in.-thick steel. It shall be nickel plated and welded to the enclosure, and shall have a short-circuit rating equal to that of the pad-mounted gear.

C. Ground-connection pads shall be coated with a uniform coating of an oxide inhibitor and sealant prior to shipment.

D. A copper rod, connected to the ground-connection pad, shall be provided in each termination compartment for switches and bus. The rod shall have a diameter no less than 3/8-in. and extend across the full width of the compartment to allow convenient grounding of cable concentric neutrals and accessories, and shall have a short-circuit rating equal to that of the pad-mounted gear.

E. Continuous copper ground bus shall be provided across the full width of each termination compartment for fuses. For each fuse mounting, there shall be a ground ring made of 3/8 in.-diameter copper rod bolted to the ground bus and placed to allow convenient grounding of cable concentric neutrals and accessories. Ground rings and bus shall have a short-circuit rating equal to that of the pad-mounted gear.

2.4 BUSHINGS AND BUSHING WELLS

A. Bushings and bushing wells shall conform to ANSI/IEEE Standard 386.

B. Bushings and bushing wells shall be of a cycloaliphatic epoxy resin system with characteristics and restrictions as follows:

1. Operating experience of at least 15 years under similar conditions.
2. Adequate leakage distance for in-air application established by test per IEC Publication 507, “Artificial Pollution Test on High Voltage Insulators to be Used on AC Systems.”
3. Adequate strength for short-circuit stress established by test.
4. Conformance with applicable ANSI standards.
5. Homogeneity of the cycloaliphatic epoxy resin throughout each bushing or bushing well to provide maximum resistance to power arcs. Ablation due to high temperatures from power arcs shall continuously expose more material of the same composition and properties so that no change in mechanical or electrical characteristics takes place because of arc-induced ablation.

C. Bushings and bushing wells shall be mounted in such a way that the semiconductive coating is solidly grounded to the enclosure.

D. Bushings rated 600 amperes continuous shall have a removable threaded stud so that the bushings are compatible with all 600-ampere elbow systems—those requiring a threaded stud as well as those that do not.

2.5 TERMINATION COMPARTMENTS

A. Termination compartments for switches shall have bushings, and termination compartments for fuses shall have bushing wells to permit connection of elbows. The bushings and bushing wells shall be mounted on the interior walls at a minimum height of 33 inches above the enclosure base.

B. Termination compartments for bus shall have bushing wells to permit connection of elbows. The bushing wells shall be mounted on the interior walls at a minimum height of 25 inches above the enclosure base.

C. Termination compartments for bushings rated 600 amperes continuous shall be of an adequate depth to accommodate two 600-ampere elbows mounted piggyback, encapsulated surge arresters or grounding elbows mounted on 600-ampere elbows having 200-ampere interfaces, or other similar accessory combinations without the need for an enclosure extension.

D. Termination compartments shall be provided with one parking stand for each bushing or bushing well. The parking stand shall be located immediately adjacent to the associated bushing or bushing well and shall accommodate standard feedthrus and standoff insulators, and other similar accessories.

E. Each termination compartment for a switch shall be equipped with a viewing window to allow visual inspection of interrupter switch blades to allow positive verification of switch position.

F. Each termination compartment for a set of fuses shall be equipped with a set of viewing windows to allow visual inspection of blown-fuse indicators.

2.6 ENCLOSURE

A. The pad-mounted gear enclosure shall be of unitized monocoque (not structural-frame-and-bolted-sheet) construction to maximize strength, minimize weight, and inhibit corrosion.

B. The basic material shall be 11-gauge hot-rolled, pickled and oiled steel sheet.

C. All structural joints and butt joints shall be welded, and the external seams shall be ground flush and smooth. The gas-metal-arc welding process shall be employed to eliminate alkaline residues and to minimize distortion and spatter.

D. To guard against unauthorized or inadvertent entry, enclosure construction shall not utilize any externally accessible hardware.

E. The base shall consist of continuous 90-degree flanges, turned inward and welded at the corners, for bolting to the concrete pad.

F. The door openings shall have 90-degree flanges, facing outward, that shall provide strength and rigidity as well as deep overlapping between doors and door openings to guard against water entry.

G. Gasketing between the roof and the enclosure shall guard against entry of water and airborne contaminants and shall discourage tampering or insertion of foreign objects.

H. An internal steel-enclosed compartment shall encase the interrupter switches and fuses for electrical isolation and protection from contamination. The compartment shall have a galvanized steel sheet floor to exclude foliage and animals. The floor shall have screened drain vents to allow drainage if the enclosure is flooded. The top of this compartment shall be gasketed to provide sealing with the enclosure roof.

I. Insulating barriers of NEMA GPO3-grade fiberglass-reinforced polyester shall be provided for each interrupter switch where required to achieve BIL ratings. Additional insulating barriers of the same material shall isolate the tie bus (where furnished).

J. Full-length steel barriers shall separate adjoining termination compartments.

K. Lifting tabs shall be removable. Sockets for the lifting-tab bolts shall be blind-tapped. A resilient material shall be placed between the lifting tabs and the enclosure to help prevent corrosion by protecting the finish against scratching by the tabs. To further preclude corrosion, this material shall be closed-cell to prevent moisture from being absorbed and held between the tabs and the enclosure in the event that lifting tabs are not removed.

1. The enclosure shall be provided with an instruction manual holder.

2.7 DOORS

A. Doors shall be constructed of 11-gauge hot-rolled, pickled and oiled steel sheet.

B. Door-edge flanges shall overlap with door-opening flanges to discourage tampering or insertion of foreign objects.

C. Doors shall have a minimum of two extruded-aluminum hinges with stainless-steel hinge pins, and interlocking extruded-aluminum hinge supports for the full length of the door to provide strength, security, and corrosion resistance. Mounting hardware shall be stainless steel or zinc-nickel-plated steel, and shall not be externally accessible to guard against tampering.

D. Doors shall be hinged at the sides to swing open with minimum effort. Doors hinged at the top requiring significant effort to lift open shall not be allowed.

E. In consideration of controlled access and tamper resistance, each door (or set of double doors) shall be equipped with an automatic three-point latching mechanism.

1. The latching mechanism shall be spring-loaded, and shall latch automatically when the door is closed. All latch points shall latch at the same time to preclude partial latching.

2. A pentahead socket wrench or tool shall be required to actuate the mechanism to unlatch the door and, in the same motion, recharge the spring for the next closing operation.

3. The latching mechanism shall have provisions for padlocking that incorporate a means to protect the padlock shackle from tampering and that shall be coordinated with the latches such that:

a. It shall not be possible to unlatch the mechanism until the padlock is removed, and

b. It shall not be possible to insert the padlock until the mechanism is completely latched closed.

F. Doors providing access to solid-material power fuses shall have provisions to store spare fuse units or refill units.

G. Each door shall be provided with a zinc-nickel-plated steel door holder located above the door opening. The holder shall be hidden from view when the door is closed, and it shall not be possible for the holder to swing inside the enclosure.

2.8 ROOF

A. The roof shall be constructed of 11-gauge hot-rolled, pickled and oiled steel sheet.

B. A heavy coat of insulating “no-drip” compound shall be applied to the inside surface of the center roof section to minimize condensation of the moisture thereon.

C. Roof sections over termination compartments shall be liftable and hinged to allow room for cable pulling during installation. Each roof section shall require minimal effort to open and close and shall have a retainer to hold it in the open position.

D. A mechanical interlock shall be provided to ensure that the roof sections over the termination compartments are closed and secured before allowing full engagement of the door latching mechanism.

E. Roof sections over high-voltage compartments shall be bolted to the enclosure with no exposed fasteners.

2.9 FINISH

A. Full coverage at joints and blind areas shall be achieved by processing enclosures independently of components such as doors and roofs before assembly into the unitized structures.

B. All exterior seams shall be filled and sanded smooth for neat appearance.

C. To remove oils and dirt, to form a chemically and anodically neutral conversion coating to improve the finish-to-metal bond, and to retard underfilm propagation of corrosion, all surfaces shall undergo a thorough pretreatment process comprised of a fully automated system of cleaning, rinsing, phosphatizing, sealing, drying, and cooling before any protective coatings are applied. By utilizing an automated pretreatment process, the enclosure shall receive a highly consistent thorough treatment, eliminating fluctuations in reaction time, reaction temperature, and chemical concentrations.

D. After pretreatment, protective coatings shall be applied that shall help resist corrosion and protect the steel enclosure. To establish the capability to resist corrosion and protect the enclosure, representative test specimens coated by the enclosure manufacturer’s finishing system shall satisfactorily pass the following tests:

1. 4000 hours of exposure to salt-spray testing per ASTM B 117 with:

   a. Underfilm corrosion not to extend more than 1/32 in. from the scribe, as evaluated per ASTM D 1645, Procedure A, Method 2 (scraping); and

   b. Loss of adhesion from bare metal not to extend more than 1/8 in. from the scribe.

2. 1000 hours of humidity testing per ASTM D 4585 using the Cleveland Condensing Type Humidity Cabinet, with no blistering as evaluated per ASTM D 714.

3. 500 hours of accelerated weathering testing per ASTM G 53 using lamp UVB-313, with no chalking as evaluated per ASTM D 659, and no more than 10% reduction of gloss as evaluated per ASTM D 523.
4. Crosshatch-adhesion testing per ASTM D 3359 Method B, with no loss of finish.
5. 160-inch-pound impact, followed by adhesion testing per ASTM D 2794, with no chipping or cracking.
6. 3000 cycles of abrasion testing per ASTM 4060, with no penetration to the substrate.
7. Certified test abstracts substantiating the above capabilities shall be furnished upon request.

E. After the finishing system has been properly applied and cured, welds along the enclosure bottom flange shall be coated with a wax-based anticorrosion moisture barrier to give these areas added corrosion resistance.

F. A resilient closed-cell material, such as PVC gasket, shall be applied to the entire underside of the enclosure bottom flange to protect the finish on this surface from scratching during handling and installation. This material shall isolate the bottom flange from the alkalinity of a concrete foundation to help protect against corrosive attack.

G. After the enclosure is completely assembled and the components (switches, fuses, bus, etc.) are installed, the finish shall be inspected for scuffs and scratches. Blemishes shall be touched up by hand to restore the protective integrity of the finish.

H. The finish shall be olive green, Munsell 7GY3.29/1.5.

2.10 CORROSION PROTECTION

A. To guard against corrosion, all hardware (including door fittings, fasteners, etc.), all operating-mechanism parts, and other parts subject to abrasive action from mechanical motion shall be of either nonferrous materials, or galvanized or zinc-nickel-plated ferrous materials. Cadmium-plated ferrous parts shall not be used.

2.11 INTERRUPTER SWITCHES

A. Interrupter switches shall be enclosed in an inner steel compartment and shall be provided with bushings rated 600 amperes continuous to permit connection of elbows external to the switch compartment.

B. Interrupter switches shall have a three-time duty-cycle fault-closing rating equal to or exceeding the short-circuit rating of the pad-mounted gear. These ratings define the ability to close the interrupter switch three times against a three-phase fault with asymmetrical current in at least one phase equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current. Tests substantiating these ratings shall be performed at maximum voltage with current applied for at least 10 cycles. Certified test abstracts establishing such ratings shall be furnished upon request.

C. Interrupter switches shall be operated by means of an externally accessible 3/4-in. hex switch-operating hub. The switch-operating hub shall be located within a recessed stainless-steel pocket mounted on the side of the pad-mounted gear enclosure and shall accommodate a 3/4-in. deep-socket wrench or a 3/4-in. shallow-socket wrench with extension. The switch-operating-hub pocket shall include a padlockable stainless-steel access cover that shall incorporate a hood to protect the padlock shackle from tampering. Stops shall be provided on the switch-operating hub to prevent overtravel and thereby guard against damage to the interrupter switch quick-make quick-break mechanism. Labels to indicate switch position shall be provided in the switch-operating-hub pocket.

D. Each interrupter switch shall be provided with a folding switch-operating handle. The switch-operating handle shall be secured to the inside of the switch-operating-hub pocket by a brass chain. The folded handle shall be stored behind the closed switch-operating-hub access cover.

E. Interrupter switches shall utilize a quick-make quick-break mechanism installed by the switch manufacturer. The quick-make quick-break mechanism shall be integrally mounted on the switch frame, and shall swiftly and positively open and close the interrupter switch independent of the switch-operating-hub speed.

F. Each interrupter switch shall be completely assembled and adjusted by the switch manufacturer on a single rigid mounting frame. The frame shall be of welded steel construction such that the frame intercepts the leakage path which parallels the open gap of the interrupter switch to positively isolate the load circuit when the interrupter switch is in the open position.

G. Interrupter switch contacts shall be backed up by stainless-steel springs to provide constant high contact pressure.

H. Interrupter switches shall be provided with a single blade per phase for circuit closing, including fault closing, continuous current carrying, and circuit interrupting. Spring-loaded auxiliary blades shall not be permitted. Interrupter switch blade supports shall be permanently molded in place in a unified insulated shaft constructed of the same cycloaliphatic epoxy resin as the insulators.

I. Circuit interruption shall be accomplished by use of an interrupter which is positively and inherently sequenced with the blade position. It shall not be possible for the blade and interrupter to get out of sequence. Circuit interruption shall take place completely within the interrupter, with no external arc or flame. Any exhaust shall be vented in a controlled manner through a deionizing vent.

J. Key interlocks shall be provided to guard against opening the door(s) of fuse-termination compartment(s) unless all switches are locked open.

2.12 FUSES

A. Solid-Material Power Fuses

1. Solid-material power fuses shall utilize refill-unit-and-holder or fuse-unit-and-end-fitting construction. The refill unit or fuse unit shall be readily replaceable and low in cost.

2. Fusible elements shall be nonaging and nondamageable so it is unnecessary to replace unblown companion fuses following a fuse operation.
3. Fusible elements for refill units or fuse units, rated 10 amperes or larger, shall be helically coiled to avoid mechanical damage due to stresses from current surges.
4. Fusible elements that carry continuous current shall be supported in air to help prevent damage from current surges.
5. Refill units and fuse units shall have a single fusible element to eliminate the possibility of unequal current sharing in parallel current paths.
6. Solid-material power fuses shall have melting time-current characteristics that are permanently accurate to within a maximum total tolerance of 10% in terms of current. Time-current characteristics shall be available which permit coordination with source-side and load-side protective relays, automatic circuit reclosers, and other fuses.
7. Solid-material power fuses shall be capable of detecting and interrupting all faults, whether large, medium, or small (down to minimum melting current); under all realistic conditions of circuitry; and with line-to-line or line-to-ground voltage across the fuse. They shall be capable of handling the full range of transient recovery voltage severity associated with these faults.
8. All arcing accompanying solid-material power fuse operation shall be contained within the fuse, and all arc products and gases evolved shall be effectively contained within the exhaust control device during fuse operation.
9. Solid-material power fuses shall be equipped with a blown-fuse indicator that shall provide visible evidence of fuse operation while installed in the fuse mounting.

2.13 HAZARD-ALERTING SIGNS

A. All external doors shall be provided with “Warning—Keep Out—Hazardous Voltage Inside—Can Shock, Burn, or Cause Death” signs.

B. The inside of each door shall be provided with a “Danger—Hazardous Voltage—Failure to Follow These Instructions Will Likely Cause Shock, Burns, or Death” sign. The text shall further indicate that operating personnel must know and obey the employer’s work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment.

C. Termination compartments shall be provided with “Danger—Keep Away—Hazardous Voltage—Will Shock, Burn, or Cause Death” signs.

2.14 NAMEPLATES, RATINGS LABELS, AND CONNECTION DIAGRAMS

A. The outside of each door (or set of double doors) shall be provided with a nameplate indicating the manufacturer's name, catalog number, model number, date of manufacture, and serial number.

B. The inside of each door (or set of double doors) shall be provided with a ratings label indicating the following:

1. Overall pad-mounted gear ratings: nominal voltage, kV; maximum voltage, kV; BIL voltage, kV; power frequency, Hz; short-circuit peak withstand current, amperes, peak; short-circuit one-second short-time withstand current, amperes, RMS, symmetrical; and short-circuit MVA, three-phase symmetrical, at rated nominal voltage.

2. Main bus ratings: continuous current, amperes; peak withstand current, amperes, peak; and one-second short-time withstand current, amperes, RMS symmetrical.

3. Switch ratings: continuous current, amperes; load splitting current, amperes; load dropping current, amperes; peak withstand current, amperes, peak; one-second short-time withstand current, amperes, RMS, symmetrical; and three-time duty-cycle fault-closing current, amperes, RMS symmetrical and amperes, peak.

4. Fuse type and ratings: maximum current, amperes and interrupting current, amperes, RMS, symmetrical.

C. A three-line connection diagram showing interrupter switches, fuses, and bus along with the manufacturer's model number shall be provided on the inside of each door (or set of double doors), and on the inside of each switch-operating-hub access cover.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify service equipment is ready to be connected and energized.

3.2 INSTALLATION

A. Install service entrance conduits to building service entrance pad mount transformer.

END OF SECTION

SECTION 26 12 00

PAD-MOUNTED TRANSFORMERS, LIQUID FILLED

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 0 – Bidding and Contract Requirements and Division 1 – General Requirements specification sections, apply to this Section.

1.2 REFERENCES

A. IEEE C37.47™ - Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses

B. IEEE C57.12.00™ - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

C. IEEE C57.12.10™ – Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers: High Voltage, 34,500 GrdY/19,900 Volts and Below; Low Voltage, 480 Volts and Below.

D. ANSI C57.12.28 - Switchgear and Transformers, Pad-Mounted Equipment - Enclosure Integrity

E. IEEE C57.12.90™ - Standard Test Code for Liquid-Immersed Distribution Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers

F. IEEE C57.13™ - Requirements for Instrument Transformers

G. ANSI/IEEE 386 - Separable Insulated Connector Systems for Power Distribution Systems Above 600 V

H. ASTM D877 - Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes

I. NEMA AB1 - Molded Case Circuit Breakers

J. CAN/CSA-C88-M90 - Electrical Power Systems and Equipment

1.3 SUBMITTALS

A. Submit shop drawings indicating outline dimensions, connection and support points, weight, specified ratings and materials.

B. Submit product data indicating standard model design tests and options.

C. Submit manufacturer's installation instructions.

1.4 OPERATION AND MAINTENANCE DATA

A. Include procedures for sampling and maintaining fluid, maintaining unit, and replacing components.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in distribution transformers with 10 years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Square D Company.
B. Cooper.
C. ABB.
D. Siemens.
E. GE.
F. Culter-Hammer.

2.2 FLUID-FILLED PAD-MOUNTED TRANSFORMERS

A. The transformer shall be 500 kVA compartment type, self-cooled, for mounting on a pad and shall comply with the latest applicable standards.

B. The average temperature rise of the windings, measured by the resistance method, shall be 65°C and 55°C /65°C (as noted on drawings) when the transformer is operated at rated kVA output. The transformer shall be capable of being operated at rated load in a 30° C average, 40° C maximum ambient, as defined by IEEE C57.12.00 without loss of service life expectancy.

C. Coolant and insulating fluid shall be less flammable seed-oil based fluid as defined by the NEC and approved by FM (300ºC flashpoint/350ºC firepoint).

D. The high and low voltage compartments shall be located side by side, separated by a steel barrier. When facing the transformer, the low voltage compartments shall be on the right. Terminal compartments shall be full height, air-filled, with individual doors. The high voltage door fastenings shall not be accessible until the low voltage door has been opened.

E. The following accessories shall be provided as standard on all transformers:

1. Nameplate in low voltage compartment.
2. 1” upper filter press and filling plug

3. 1” Drain valve with sampling device.
4. Lightning arrester mounting provisions.
5. Tap changer with silver-plated stationary and movable contacts, for de-energized operation only, which is externally operable and padlockable.
6. The front of both compartments shall be removable to allow the transformer to be rolled or skidded into position over conduit stubs. ANSI tank grounding provisions shall be furnished in both compartments.
7. Dial type thermometer.
8. Magnetic liquid-level gauge.
9. Pressure vacuum gauge.
10. Pressure relief valve.
11. Pentahead bolts for compartment doors.

F. The transformer(s) shall be rated as shown on drawings, self cooled (ONAN). Primary voltage 12,470 delta. Secondary voltage 480/277 wye, 4-wire, 60 Hz with two 2-1/2% full capacity above normal and two 2-1/2% below normal taps. Impedance shall be manufacturer's standard impedance, ±7-1/2%. Basic impulse level of the primary winding shall be 95kV.

G. The transformer shall be of sealed-tank construction of sufficient strength to withstand a pressure of 7 psi without permanent distortion. The cover shall be welded and the handhole fastenings tamper-resistant. The transformer shall remain effectively sealed for a top oil temperature range of –5° C to 105° C. When required, cooling panels will be provided on the back and sides of the tank. Lifting eyes and jacking provisions will be provided.

H. Coils shall be wound with aluminum conductors.

I. All cores to be constructed of high grade, grain-oriented, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux is to be kept well below the saturation point.

J. The high voltage terminations and equipment shall be dead front.

K. HV dead front bushings shall be 600A, either universal wells or one-piece integrated for use with separable connectors. Bushings shall be externally clamped and front removable.

L. The low voltage bushings (≤600V) shall be molded polymer, and provided with blade-type spade terminals with NEMA standard hole spacing arranged for vertical take-off. The low voltage neutral shall be an insulated bushing, grounded to the tank by a removable ground strap.

M. Provide a load break, gang operated, liquid immersed switch rated at 600A that is externally operable from the high voltage compartment through the use of a distribution hot-stick. Switch to be 4-position "sectionalizing" type for use on an extended radial or loop-feed system with feed-from-the-left, feed-from-the-right, isolated-from-either-side, or through-feed to both sides.

N. Provide bayonet type liquid immersed fuses that are externally replaceable with a hot-stick without opening the transformer tank.

O. Surge Protection - Provide three distribution class lightning arresters for surge protection. Arresters are to be mounted in the high voltage compartment.

P. Additional Accessories

1. Automatic pressure relief device (self-sealing with indicator).
2. Mounting provisions for low voltage current transformers and potential transformers.
3. Sudden pressure relay.
4. Key interlock to primary or secondary compartment door.
5. Bushing well inserts
6. Feed-thru inserts (Loop feed).
7. MOVE elbow arresters.

Q. Transformer shall be UL listed.

R. Testing - Tests shall be conducted in accordance with the provisions of IEEE C57.12.90 and shall include, as a minimum, the following tests:

1. Ratio
2. Polarity
3. Phase Rotation
4. No-Load Loss
5. Excitation Current
6. Impedance Voltage
7. Load Loss
8. Applied Potential
9. Induced Potential
10. QC Impulse Test

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that pads are ready to receive work.

B. Verify field measurements.

C. Verify that required utilities are available, in proper location and ready for use.

D. Beginning of installation means Contractor accepts conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install safety labels to NEMA 260.

3.3 FIELD QUALITY CONTROL

A. Perform NETA Visual and Mechanical Inspection

B. Perform NETA turns-ratio test on all no-load tap-changer positions and all load tap-changer positions. Verify that tap setting is as specified. Verify that winding polarities are in accordance with nameplate.

C. Perform NETA insulation power-factor/dissipation-factor tests on all windings and bushings.

3.4 ADJUSTING

A. Adjust primary taps so that secondary voltage is within 2% of rated voltage.

END OF SECTION 26 12 00

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Dry-type energy efficient transformers per NEMA TP1, with primary and secondary voltages of 600V and less and capacity ratings 15kVA through 750kVA.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code
B. NEMA ST20
C. UL 1561
D. NEMA TP1
E. NEMA TP2

1.4 SUBMITTALS

A. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

B. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

C. Suppliers asking consideration as an approved equal shall submit complete, warranted performance data and physical dimensions for similar transformers. Data shall be submitted for each size specified, and shall be received by the consultant engineer no less than 10 days prior to the bid due date for consideration.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of transformers.

1.6 STANDARDS

A. Transformers 750kVA and smaller shall be listed by Underwriters Laboratories.

B. Conform to the requirements of ANSI/NFPA 70.

C. Transformers are to be manufactured and tested in accordance with NEMA ST20.

D. Transformers losses shall conform to NEMA TP1 requirements

E. Transformers losses shall be tested in accord with NEMA TP2 procedures

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 20 years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1. Square-D
2. Cutler-Hammer
3. Siemens
4. GE

2.2 RATINGS INFORMATION

1. All insulating materials are to exceed NEMA ST20 standards and be rated for 220°C UL component recognized insulation system.

2. Transformers 15kVA and larger shall be 150°C temperature rise above 40oC ambient. Transformers 25kVA and larger shall have a minimum of 4 - 2.5% full capacity primary taps. Exact voltages and taps to be as designated on the plans or the transformer schedule.

3. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

4. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accord with NEMA TP2.

Single Phase		Three Phase	
kVA	Efficiency	kVA	Efficiency
15	97.7%	15	97.0%
25	98.0%	30	97.5%
37.5	98.2%	45	97.7%
50	98.3%	75	98.0%
75	98.5%	112.5	98.2%
100	98.6%	150	98.3%
167	98.7%	225	98.5%
250	98.8%	300	98.6%
333	98.9%	500	98.7%
		750	98.8%

5. The transformer(s) shall be rated as indicated on the drawings.

2.3 CONSTRUCTION

A. Transformer coils shall be of the continuous wound construction and shall be impregnated with nonhygroscopic, thermosetting varnish

B. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.

C. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.

D. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degeasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use. The coating color shall be ANSI 49.

2.4 SOUND LEVELS

A. Sound levels shall be warranted by the manufacturer not to exceed the following:
   1. 15 to 50KVA - 45dB; 51 to 150kVA - 50dB; 151 to 300kVA - 55dB; 301 to 500kVA - 60dB; 501 to 700kVA - 62dB; 701 to 1000kVA - 64dB; 1001 to 1500kVA - 65dB; 1501 to 2000kVA- 66dB

2.5 OPTIONAL ACCESSORIES

A. Provide weathershields for all exterior transformers.

B. Provide wall mounting brackets for all wall mounted transformers as indicated on the drawings.

C. Provide ceiling mounting brackets for all ceiling mounted transformers as indicated on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure, unless otherwise noted.

C. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.

D. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.

E. Mount trapeze-mounted transformers as indicated on Drawings.

F. Install grounding and bonding.

3.3 FIELD QUALITY CONTROL

A. Perform NETA Visual and Mechanical Inspection.

3.4 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

C. Project Commissioning shall be provided by the Owner. Contractor shall coordinate their activities with this service.

1.2 SUMMARY

A. Section includes distribution and branch circuit panelboards.

1.3 REFERENCES

A. NEMA PB 1 - Panelboards

B. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

C. NEMA AB 1 - Molded Case Circuit Breakers

D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

E. UL 50 - Enclosures for Electrical Equipment

F. UL 67 - Panelboards

G. UL 98 - Enclosed and Dead-front Switches

H. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures

I. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards

J. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers

K. Federal Specification W-P-115C - Type I Class 1

L. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.

M. NFPA 70 - National Electrical Code (NEC)

N. ASTM - American Society of Testing Materials

1.4 SUBMITTALS

A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.

B. Product Data: Submit catalog data showing specified features of standard products.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

B. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum fifty years documented experience.

1.7 MAINTENANCE MATERIALS

A. Furnish five of each panelboard key. Panelboards keyed alike.

PART 2 PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

A. Manufacturers:
1. Square-D
2. Cutler-Hammer
3. Siemens
4. GE

B. Interior

1. Panelboard shall have continuous main current ratings, as indicated on associated schedules and drawings, not to exceed 1000 amperes for main breaker panelboards and not to exceed 1200 amperes for main lug panelboards.

2. Minimum Short Circuit Rating: As indicated on the schedules and drawings.

3. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be plated copper aluminum. Bussing rated for 600, 800, and 1000 amperes shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.

4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.

5. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided when indicated.

6. Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cable may be of the same length. Provide CSA and UL Listed panelboards with 200% rated solid neutral for non-linear load applications when indicated. Panelboards shall be marked for non-linear load applications.

7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting space.

8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, CSA/UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

9. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 125A interiors shall be horizontally mounted. Main circuit breakers over 125A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.

10. Interior phase bus shall be pre-drilled to accommodate field installable options. (i.e., Sub-Feed Lugs, Sub-Feed Breakers, Thru-Feed Lugs)

11. Interiors shall accept 125 ampere breakers in group mounted branch construction.

12. Provide additional lugs to accommodate the oversized feeders.

C. Main Circuit Breaker

1. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.

2. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
3. Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be CSA and UL Listed for reverse connection without restrictive line or load markings.
4. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
5. Lugs shall be CSA and UL Listed to accept solid or stranded copper conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Lug body shall be bolted in place; snap-in designs are not acceptable.
6. The circuit breakers shall be CSA and UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

D. Branch Circuit Breakers

1. Circuit breakers shall be CSA and UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the panelboard schedules and drawings.
2. Molded case branch circuit breakers shall have bolt-on type bus connectors.
3. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
4. There shall be two forms of visible trip indication. The circuit breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red VISI-TRIP® indicator appearing in the clear window of the circuit breaker housing.
5. The exposed faceplates of all branch circuit breakers shall be flush with one another.
6. Lugs shall be UL Listed to accept solid or stranded copper conductors only. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16.
7. Breakers shall be CSA and UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.
8. Breaker shall be CSA and UL Listed with the following ratings: (15-125A) Heating, Air Conditioning, and Refrigeration (HACR), (15-30A) High Intensity Discharge (HID), (15-20A) Switch Duty (SWD), (15-50A) Equipment Protection Device (EPD) (480Y/277Vac maximum).

E. Enclosures

1. Type 1 Boxes

a. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvannealed steel is not acceptable.

b. Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.

c. Box width shall not exceed 20” wide.

2. Type 1 Fronts

a. Front shall meet strength and rigidity requirements per UL 50 standards. Shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

b. Fronts shall be hinged 1-piece with door. Mounting shall be flush or surface as indicated on associated schedules and drawings.

c. Panelboards rated 250 amperes and below shall have MONO-FLAT fronts with concealed door hinges and trim screws. Front shall not be removable with the door locked. Panelboards rated above 250 amperes shall have vented fronts with concealed door hinges. Doors on front shall have rounded corners; edges shall be free of burrs.

d. Front shall have flat latch type lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

E. Install filler plates for unused spaces in panelboards.

F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.

G. Install engraved plastic nameplates.

H. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Minimum spare conduits: 8 empty 1 inch. Identify each as SPARE.

I. Ground and bond panelboard enclosure. Connect equipment ground bars of panels in accordance with NFPA 70.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Inspect and report concealed damage to carrier within their required time period.

B. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

3.3 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of one (1) year from the date of substantial completion.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

C. Perform switch inspections and tests listed in NETA ATS, Section 7.5.

D. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.5 ADJUSTING

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

B. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

END OF SECTION

SECTION 26 27 16

ELECTRICAL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes hinged cover enclosures, cabinets, terminal blocks, and accessories.

1.3 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.

B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.6 EXTRA MATERIALS

A. Furnish five of each key.

PART 2 PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Manufacturers:
   1. Carlon Electrical Products
   2. Hubbell Wiring Devices
   3. Reliance Electric
   4. Hoffman
   5. Square-D
   6. Siemens
   7. Cutler-Hammer
   8. Hammond

B. Construction: NEMA 250, Type 1 steel enclosure.

C. Covers: Continuous hinge, held closed by flush latch operable by screwdriver.

D. Furnish interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.

E. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

A. Manufacturers:
   1. Carlon Electrical Products
   2. Hubbell Wiring Devices
   3. Reliance Electric
   4. Hoffman
   5. Square-D
   6. Siemens
   7. Cutler-Hammer
   8. Hammond

B. Boxes: Galvanized steel with removable end walls.

C. Box Size: Per NEC angle and U-pull calculations.

D. Fronts: Steel, surface type with concealed trim clamps, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

E. Knockouts: Provide as required.

F. Furnish metal barriers to form separate compartments wiring of different systems and voltages.

G. Furnish accessory feet for free-standing equipment.

2.3 TERMINAL BLOCKS

A. Manufacturers:
   1. Carlon Electrical Products
   2. Hubbell Wiring Devices
   3. Reliance Electric
   4. Hoffman
   5. Square-D
   6. Siemens
   7. Cutler-Hammer
   8. Hammond
   9. Ilsco
   10. Burndy

B. Terminal Blocks: NEMA ICS 4.

C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

E. Furnish ground bus terminal block, with each connector bonded to enclosure.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.

B. Install cabinet fronts plumb.

3.2 CLEANING

A. Clean electrical parts to remove conductive and harmful materials.

B. Remove dirt and debris from enclosure.

C. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

C. Project Commissioning shall be provided by the Owner. Contractor shall coordinate their activities with this service.

1.2 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; multi-outlet assembly; and device plates and decorative box covers.

1.3 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.
B. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 EXTRA MATERIALS

A. Furnish two of each style, size, and finish wall plate.

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
   1. Cooper Wiring Devices.
   2. Hubbell, Inc.
   3. Leviton Manufacturing Company.

B. Product Description: NEMA WD 1, Extra Heavy-Duty, AC only general-use snap switch.

C. Body and Handle: Toggle.

D. Indicator Light: Lighted handle type switch.

E. Locator Light: Lighted handle type switch; red color handle.

F. Ratings:
   1. Voltage: 120-277 volts, AC.
   2. Current: 20 amperes.

G. Color: As selected by Architect.

2.2 RECEPTACLES

A. Manufacturers:
   1. Cooper Wiring Devices.
   2. Harvey Hubbell, Inc.
   3. Leviton Manufacturing Company.

B. Product Description: NEMA WD 1, Extra Heavy-duty general use receptacle.

C. Device Body: Color as selected by Architect.

D. Configuration: NEMA WD 6, type.

E. Convenience Receptacle: Type 5-20R.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

A. Manufacturers:
   1. Cooper Wiring Devices.
   2. Harvey Hubbell, Inc.
   3. Leviton Manufacturing Company.

B. Decorative Cover Plate: Brushed 302 stainless steel.

C. Jumbo Cover Plate: Brushed 302 stainless steel.

D. Weatherproof Cover Plate: Gasketed cast metal plate with hinged and gasketed device cover.

PART 3 EXECUTION

3.1 EXAMINATION

A. This Contractor shall examine all architectural drawings and details before locating outlets. Outlets shall be placed as required to harmonize with moldings, panels, etc. Outlet locations shall not be obtained from scale dimensions on electrical drawings but from measurements on architectural plans and/or details.

B. If an outlet is installed by this Contractor in such a location as to be out of proper relation to beams, walls, or other details of the building, its location shall be corrected by, and at the expense of this Contractor, at the direction of the Design Professional.

C. Verify outlet boxes are installed at proper height.

D. Verify wall openings are neatly cut and completely covered by wall plates.

E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

A. Disconnect and remove abandoned wiring devices.

B. Modify installation to maintain access to existing wiring devices to remain active.

C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

A. Provide for each device indicated, a box suited to the purpose for which the device is to be put and to the location in which it occurs.

B. Do not install device boxes back to back.

C. Coordinate with Design Professional prior to installation for all device mounting heights.

D. Secure electrical devices firmly in place within boxes, setting devices straight and true with box sides and mounting surface.

E. Install face plate straight and true with mounting surface.

1. Gaps between back of plate and mounting surface are not permitted.
2. Set face plate mounting screws with slots in vertical direction.

F. All backboxes recessed in concrete in CMU masonry walls shall sit flush with face of wall. Provide boxes with proper depth and/or extension ring.

G. Wiring devices to be furnished and installed by this Contractor shall consist of the various types of wall switches, receptacles, outlets, and plates as required for the Electrical Work. The extent of the wiring devices shall be shown on the drawings.

H. Local wall switches near doors shall be located on the strike side of doors as finally hung, whether or not so indicated on the Plans. If, because of the construction, it is not practical to mount on the strike side, these locations shall be brought to the Design Professional's attention, and meet his approval before roughing in.

I. Single pole switches shall switch the ungrounded wire of circuits. Neutral wire shall not run through switches provided with a neutral shunt or bridge.

J. Switches shall be mounted with the long dimensions vertical.

K. All receptacles and communication outlets located next to each other shall be mounted 8" apart (horizontally) center to center.

L. All switches located adjacent to each other shall be ganged under single multi-gang cover plate.

M. Install devices plumb and level.

N. Install switches with OFF position down.

O. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

P. Do not share neutral conductor on load side of dimmers.

Q. Install receptacles with grounding pole on bottom.

R. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

S. Install wall plates on flush mounted switches, receptacles, and blank outlets.

T. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

U. Connect wiring devices by wrapping solid conductor around screw terminal.

V. Use jumbo size plates for outlets installed in masonry walls.

W. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install wall switch 48 inches above finished floor.

B. Install convenience receptacle 18 inches above finished floor.

C. Install convenience receptacle 6 inches above back splash of counter.

D. Install dimmer 48 inches above finished floor.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 19

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes fusible and non-fusible switches.

1.3 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

A. Product Data: Submit switch ratings and enclosure dimensions.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. Square-D
   2. Cutler-Hammer
   3. Siemens
   4. GE

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.
   3. Industrial Locations: Type 4X

E. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

F. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. Square-D
   2. Cutler-Hammer
   3. Siemens

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.
   3. Industrial Locations: Type 4X

D. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

E. Furnish switches with entirely copper current carrying parts.

F. Provide auxiliary contacts for all switches associated with the Smoke Control System.

2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

PART 3 EXECUTION

3.1 INSTALLATION

A. Height: 5 feet to operating handle.

B. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

C. Install engraved plastic nameplates in accordance with Section 26 05 53.

D. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION

SECTION 26 28 23

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes molded-case and insulated-case circuit breakers in individual enclosures.

1.3 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

A. Product Data: Submit catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and continuous current ratings of enclosed circuit breakers.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

1.7 EXTRA MATERIALS

A. Furnish five of each size and type of current limiter.

PART 2 PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKER

A. Manufacturers:
   1. Square-D
   2. Cutler-Hammer
   3. Siemens
   4. GE

B. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.

C. Service Conditions:
   1. Temperature: 104 degrees F.
   2. Altitude: 3300 feet.

D. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 250 amperes and larger have mechanism for adjusting long time, short time, continuous current, short time, long time pickup current setting for automatic operation.

E. Field-Changeable Ampere Rating Circuit Breaker: Circuit breakers with frame sizes 250 amperes and larger have changeable trip units.

F. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.

G. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings, instantaneous trip, and adjustable short time trip.

H. Accessories: As indicated on Drawings. Conform to NEMA AB 1.
   1. Shunt Trip Device: 120 volts, AC.
   2. Auxiliary Switch: 120 volts, AC.
   3. Handle Lock: Provisions for padlocking.

I. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.
   3. Industrial Locations: Type 4X

J. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

PART 3 EXECUTION

3.1 INSTALLATION

A. Height: 5 feet to operating handle.

B. Locate and install engraved plastic nameplates in accordance with Section 26 05 53.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1.

3.2 ADJUSTING

A. Adjust trip settings to coordinate circuit breakers with other overcurrent protective devices in circuit.

B. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes manual and magnetic motor controllers in individual enclosures.

B. Related Sections:
   1. Section 26 28 13 - Fuses.

1.3 REFERENCES

A. National Electrical Manufacturers Association:

   1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
   2. NEMA FU 1 - Low Voltage Cartridge Fuses.
   3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
   5. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
   6. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:

   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

A. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

B. Test Reports: Indicate field test and inspection procedures and test results.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and ratings of enclosed controllers.

B. Operation and Maintenance Data: Submit Replacement parts list for controllers.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MANUAL MOTOR CONTROLLER

A. Manufacturers:
1. Square-D
2. Cutler-Hammer
3. Siemens
4. GE

B. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, red pilot light, and toggle operator.

C. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.2 FRACTIONAL-HORSEPOWER MANUAL CONTROLLER

A. Manufacturers:
1. Square-D
2. Cutler-Hammer
3. Siemens
4. GE

B. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, green pilot light, toggle operator.

C. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.3 MOTOR STARTING SWITCH

A. Manufacturers:
1. Square-D
2. Cutler-Hammer
3. Siemens
4. GE

B. Product Description: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with green pilot light and toggle operator.

C. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.4 FULL-VOLTAGE NON-REVERSING CONTROLLERS

A. Manufacturers:
   1. Square-D
   2. Cutler-Hammer
   3. Siemens
   4. GE

B. Product Description: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

C. Control Voltage: Coordinate in field with Mechanical/ATC Contractor prior to purchasing.

D. Control coil to be encapsulated type.

E. Control: Hand-Off-Auto with red “On” and green “Off” indicating lights and start/stop buttons.

F. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.

G. Wiring: Straight-through wiring with all terminals clearly marked.

H. Overload Relay: NEMA ICS 1:
   1. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard, and be ambient insensitive. It will also be available in Trip Class 10 or 20 and have a mechanical test function.
   2. Outputs: Unit will be designed for addition of either a normally open or normally closed auxiliary contact and be field convertible.
   3. Reset: Unit shall offer both manual reset and remote reset using an external module.
   4. Overload relay size shall be based on motor nameplate and not the starter size.

I. Product Features:
   1. Auxiliary Contacts: NEMA ICS 2, 2 each field convertible contacts in addition to seal-in contact.
   2. Cover Mounted Pilot Devices: NEMA ICS 5, heavy duty type.
   3. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
   4. Pushbuttons: Shrouded type.
   5. Indicating Lights: LED type.

6. Selector Switches: Rotary type.
7. Relays: NEMA ICS 2.
8. Control Power Transformers: Provide in each motor starter. Furnish fused primary and secondary, and bond unfused leg of secondary to enclosure.

J. MOCP Combination Controllers: Combine motor controllers with disconnect in common enclosure, using motor circuit protector conforming to NEMA AB 1, with integral instantaneous magnetic trip in each pole. Obtain IEC Class 2 coordinated component protection.

K. Non-Fused Combination Controllers: Combine motor controllers with disconnect in common enclosure, using non-fusible switch conforming to NEMA KS 1, enclosed knife switch with externally operable handle.

L. Fused Combination Controllers: Combine motor controllers with disconnect in common enclosure, using fusible switch conforming to NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses. Obtain IEC Class 2 coordinated component protection.

M. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

2.5 MOTOR CIRCUIT PROTECTORS (MOCP)

A. Motor Circuit Protector: NEMA AB 1 circuit breakers with integral instantaneous magnetic trip in each pole. Circuit breaker shall have a color coded externally operated handle Operating handle shall give positive visual indication of ON/OFF with red and black color-coding.

PART 3 EXECUTION

3.1 INSTALLATION

A. Height: 5 feet to operating handle.

B. Install fuses for fusible switches. Refer to Section 26 28 13 for product requirements.

C. Select and install overload heater elements in motor controllers to match installed motor characteristics.

D. Install engraved plastic nameplates. Refer to Section 26 05 53 for product requirements and location.

E. Neatly type label and place inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.16.1.

C. Inspect and test each controller to NEMA ICS 2.

END OF SECTION

SECTION 26 41 00

FACILITY LIGHTNING PROTECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes air terminals, interconnecting conductors, grounding, and bonding for lightning protection of the sports lighting poles.

1.3 REFERENCES

A. Lightning Protection Institute:
   1. LPI 175 - Standard of Installation.

B. National Fire Protection Association:
   1. NFPA 780 - Standard for the Installation of Lightning Protection Systems.

C. Underwriters Laboratories Inc.:
   1. UL 96 - Lightning Protection Components.
   2. UL 96A - Installation Requirements for Lightning Protection Systems.

1.4 SYSTEM DESCRIPTION

A. Description: Conductor system protecting entire pole structure and having UL Master Label.

1.5 SUBMITTALS

A. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

B. Product Data: Submit catalog sheets showing dimensions and materials of each component, and include indication of listing in accordance with UL 96.

C. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Certificate of Compliance: Submit certificate from Underwriter's Laboratories indicating approval of lightning protection systems.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 780.

B. Perform Work in accordance with UL 96A and furnish Master Label.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum twenty years documented experience and member of Lightning Protection Institute.

B. Installer: Authorized installer of manufacturer with minimum ten years documented experience.

C. Inspection Agency: Underwriter’s Laboratories, Inc. (UL)

1.9 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing work of this section.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate Work with roofing and exterior and interior finish installations.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
1. East Coast Lightning Protection.
2. Harger Inc.
3. Erico Inc.
4. Substitutions: Not Permitted.

B. Product Listing: UL 96.

C. Air Terminals:

1. Material: Aluminum.

2. Configuration: Solid.

3. Use adhesive base for single-ply roof installations.
4. Air Terminal for Chimney: Lead-coated copper.
5. Decorations: None.
6. Grounding Rods: Solid copper clad steel.
7. Ground Plate: Copper.
8. Conductors:
    a. Material: Aluminum.
    b. Configuration: Cable.

D. Connectors and Splicers: Aluminum.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 780 and UL 96A.

B. Connect exterior conductors using mechanical connectors. Connect interior conductors using exothermic welding process. Protect adjacent construction elements and finishes from damage.

3.2 FIELD QUALITY CONTROL

A. Perform inspection and testing in accordance with UL 96A.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories.

1.3 SCOPE OF WORK

A. Provide and install a complete system of lighting fixtures installed in place, including lamps, wired and connected and left in a satisfactory operating condition. At time of final approval by the Design Professional all fixtures shall be clean and any burned out lamps or ballasts replaced at no additional charge.

B. Contractor shall furnish and install a complete and fully working lighting system with all necessary components, accessories, lamps, and transformers in accordance with the manufacturer's recommendations to meet the specifications and design intent herein. It is the responsibility of the Contractor to ensure all necessary equipment, specialties, and appurtenances are included regardless of the product specification.

C. Contractor shall be responsible for verifying mounting compatibility and plenum clearance of all lighting fixtures and shall notify the Design Professional of any conflicts with structure, HVAC or plumbing prior to the ordering of the equipment in question. Any conflict will be verified in field with the Design Professional.

D. The work to be done under this project includes providing all equipment materials, labor and services, and performing all operations for a complete and operating system. Any work not specifically covered but necessary to complete this installation shall be provided. All equipment and wiring to be new and provided under this contract unless otherwise noted.

E. The Contractor shall perform all cutting and patching of existing masonry construction required by this work. All backboxes, conduit, and wiring shall be concealed in the existing construction unless otherwise noted.

F. The Contractor shall coordinate the lighting fixture installation with all other trades.

G. Upon completion of work, the Contractor shall clean light fixtures and lenses. Equipment shall be adjusted to direction by Design Professional. All systems shall be tested to satisfaction of Owner.

H. Contractor shall be responsible for final targeting of light fixtures under the observation, and according to the recommendations of the Design Professional. Aiming shall take place after dark at a mutually agreed upon time. All costs associated with this effort shall be included in the base bid. Aiming must take place after the project's amenities have been installed. Amenities shall include but not necessarily be limited to plantings, furniture, artwork, graphics, and signage. Contractor shall include in the base bid, provisions for lifts, scaffolding, ladders, and other materials required to complete these adjustments.

I. For each product and/or system, the Design Professional will review (1) original shop drawing submission and (1) resubmission of the same product and/or system. The Design Professional will charge the Contractor $275.00 per hour for review of subsequent shop drawings and review of submittals for any product and/or system not specified.

J. Any substitutions for the specified products on the lighting fixture schedule may result in an adverse change in the intended performance of the lighting fixture or lighting control.

K. The contract drawings and specifications establish the "Minimum Standard of Quality" each product and/or system must meet to be considered acceptable. Products of other manufacturers will be considered, prior to submission of bid, if the product and/or system meets or exceeds the "Minimum Standard of Quality" established by the Design Professional.

L. Approval of unspecified products and/or systems may be obtained by the Contractor who submits written requests at least seven days before the bids are due. Requests after this date will not be considered. It shall be the responsibility of the Contactor requesting the approval of unspecified products and/or systems to prove equality. This statement of proof shall include a line-by-line, item-by-item description of the specified and proposed product and/or system. The request must clearly describe each item for which the approval is requested, including (3) originals (photocopies will not be accepted) of data sheets, manufacturer's name, product name, product order number, complete specifications, descriptive data, test reports, cost savings (per fixture), and a written guarantee by the Contractor that the submitted products and/or systems comply with the specifications in all respects, and if not, will be replaced at his expense with the specified item. In addition, the Contractor shall provide electronic lighting calculations indicating illuminance levels, all data pertaining to the space model and reflectances, and the IES files for each fixture.

M. The Design Professional will review the complete submission for compliance with the contract documents. If in the opinion of the Design Professional the product and/or system is acceptable as an equal as herein described, an addendum will be issued. The acceptance will not, in any way, relieve the Contractor or his supplier/vendor from full compliance with the contract documents.

1.4 REFERENCES

A. American National Standards Institute:

1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

1.5 SUBMITTALS

A. SHOP DRAWINGS: Submit manufacturer's product data on each fixture, lamp, and ballast. See Fixture Schedule Notes for other requirements.

B. Fixture data shall include photometric test data and full catalog number indicating all accessories.

C. Contractor shall submit to the Engineer for review, photographs and specifications that may be required by the Engineer. The submission shall include all fixture types bound in one portfolio.

D. The Contractor, upon award of contract, shall immediately assemble the lighting fixture submittal package and fully coordinate purchase of fixtures with the delivery time for each fixture. The delivery time for each fixture shall be clearly noted on the shop drawings.

E. The Contractor shall include in his construction schedule, the possible rejection of shop drawings and shall be responsible for project delays associated with his failure to submit accurate and complete shop drawings.

F. The Contractor shall pay all fees required by manufacturer and Engineer for the possible expediting of fixture deliveries.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

1.7 MOCK-UP

A. Provide luminaires in ceiling assembly mock-up.

B. Locate where directed by Design Professional.

C. Incorporate accepted mockup as part of Work.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 MAINTENANCE MATERIALS

A. Furnish five of each plastic lens type.

B. Furnish stock or replacement lamps amounting to 5%, but not less than 12 lamps in each case, of each type and size lamp used in each type fixture. Deliver replacement stock as directed to OWNER'S storage space. Submit in writing to Engineer that the lamps have been delivered to the OWNER.

C. Furnish ten of each ballast type.

1.10 SUBMITTALS

A. Product Data: Required.

B. Samples: Required.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Manufacturers:

1. As Scheduled.

2. Substitutions: As Scheduled.

B. Product Description: Complete luminaire assemblies, with features, options, and accessories as indicated on Drawings.

C. Minimum Efficacy, Lamps Greater Than 100 Watts: 60 lumens/W, except where otherwise indicated or permitted by applicable code.

D. All fixtures shall comply with the standards of ETL and RLM and shall bear the National Board of Fire Underwriters label. Each fixture shall bear an I.B.E.W. label.

E. Lighting fixtures shall be of type and manufacturer as described in the lighting fixture schedule on the electrical drawings. Finish and color shall be as selected by the Architect.

F. Lighting fixtures listed on fixture schedule are series, type and modular size only. This Contractor shall be responsible to provide the proper accessories for proper installation of the fixture (i.e. plaster frame, canopies, pendant stems, aircraft cable, etc.).

G. Lamps shall be furnished and installed in each fixture.

2.2 EXIT SIGNS

A. Manufacturers:

1. As Scheduled.

B. Product Description: Complete LED luminaire assemblies, with features, options, and accessories as indicated on Drawings.

C. Product Description: Exit sign fixture.

D. Face: Translucent face with red letters on white background.

E. Input Voltage: 120,277 volts.

F. Lamps: 5 W per side, maximum.

2.3 ELECTRONIC BALLAST (PROGRAM START)

A. Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

B. Ballast shall be provided with integral leads color coded per ANSI C82.11.

C. Ballast shall be Programmed Start.

D. Ballast shall provide Independent Lamp Operation (ILO) for Instant Start ballats allowing remaining lamp(s) to maintain full light output when one or more lamps fail.

E. Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

F. Ballast shall operate from 60 Hz input source of 120V, 277V or 347V as applicable with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

G. Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

H. Ballast shall have a Power Factor greater than 0.98 for primary lamp.

I. Ballast shall have a minimum ballast factor for primary lamp application as follows: 0.75 for Low Watt, 0.85 for Normal Light Output, and 1.20 for High Light.

J. Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

K. Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.

L. Ballast shall have a Class A sound rating.

M. Ballast shall have a minimum starting temperature of -18C (0F) for standard T8 lamps and 16C (60F) for energy-saving T8 lamps.

N. Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

O. Ballast shall not contain any Polychlorinated Biphenyl (PCB).

P. Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

Q. Ballast shall comply with ANSI C62.41 Category A for Transient protection.

R. Ballast shall comply with ANSI C82.11 where applicable.

S. Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

T. Ballast shall carry a five-year warranty from date of commissioning against defects in material or workmanship.

U. Ballast shall be Advance Transformer or equal by Osram Sylvania or Lutron.

2.4 HIGH INTENSITY DISCHARGE (HID) BALLASTS

A. Manufacturers:

1. Philips Electronic North America.
2. Universal.
3. Sylvania.
4. Venture Lighting International Inc.

B. Product Description: ANSI C82.4, metal halide lamp ballast, suitable for lamp specified, with voltage to match luminaire voltage.

2.5 FLUORESCENT LAMPS

A. Manufacturers:

1. General Electric Corp.
2. Philips Electronic North America.
3. Sylvania.

2.6 HID LAMPS

A. Manufacturers:

1. General Electric Corp.
2. Philips Electronic North America.
3. Siemens Corp.
4. Venture Lighting International Inc.
5. Sylvania.

2.7 GENERATOR TRANSFER DEVICE (FIXTURE MOUNTED)

A. Generator-supplied egress lighting shall be provided by using a standard fixture equipped with a Bodine GTD generator transfer device. The device shall be capable of bypassing the wall switch when the auxiliary generator (or central inverter system) powers lighting. The device shall consist of relay switching circuitry and fusing contained in one 8” x 1.18: x 1.18” galvanized steel case; shall operate at 120 or 277 VAC, 60 Hz; shall have all inputs fused to 3A maximum; shall draw 280 mA and 1.6 watts during normal operation; and shall comply with the current NEC. The device shall be UL listed for installation inside, on top of or remote from the fixture and shall be warranted for a full five years from date of purchase.

2.8 GENERATOR TRANSFER DEVICE (REMOTE 20A)

A. Emergency egress lighting shall be provided by using lighting loads equipped with a Bodine GTD20A emergency lighting relay control device. The device shall be capable of bypassing the local switching means when normal utility power has been lost. The device shall consist of relay switching circuitry, a test switch, a normal power indicator light and an alternate power indicator light contained in one 9” x 6” x 3.5” enclosure; shall sense normal power at 120 through 277 VAC, 50/60 Hz; shall be rated for 120 277 VAC, 50/60 Hz at up to 20 amps of lighting load; shall draw 45 mA and 4.0 watts during normal sensing operation; and shall comply with the current NEC. The device shall be UL listed for field installation in indoor or damp locations and shall be warranted for a full five years from date of purchase.

PART 3 EXECUTION

3.1 INSTALLATION

A. All fixtures shall be erected and shall hang perfectly plumb with canopies set squarely against the wall or ceiling. They shall be completely wired with wires of the same grade and insulation as specified for lighting circuit work with all splices using spring type solderless connectors according to NEC rules.

B. CONTRACTOR shall check the type of ceiling where recessed fixtures are installed to be sure the proper type of mounting hardware is ordered and to determine if a lay-in type fixture or otherwise is required or if plaster rings are required. He shall be responsible to see that the proper type fixture is installed to suite the ceiling condition and mounting depth.

C. Reflectors, reflector cones and visible trim of all lighting fixtures shall not be installed until completion of plastering, ceiling tile work, painting and general clean-up. They shall be carefully handled to avoid scratching or fingerprinting and shall be, at the time of acceptance by OWNER, completely clean.

D. Fixture housing and door frames shall be fully sealed against light leakage. Light leaks between ceiling trims of recessed lighting equipment and the ceilings will not be permitted. Recessed fixture openings cut into the general construction shall not be larger than the fixtures trim ring. Contractor shall be responsible for all fixture cutting and patching.

E. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.

F. Support luminaires independent of ceiling framing.

G. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

H. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

I. Exposed Grid Ceilings: Install auxiliary members spanning ceiling grid members to support surface mounted luminaires.

J. Install recessed luminaires to permit removal from below.

K. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

L. Install clips to secure recessed grid-supported luminaires in place.

M. Install wall-mounted luminaires at height as indicated on Drawings.

N. Install accessories furnished with each luminaire.

O. Connect luminaires to branch circuit using flexible conduit.

P. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

Q. Install specified lamps in each luminaire.

R. Ground and bond interior luminaires.

3.2 FIELD QUALITY CONTROL

A. Replace defective and burnt out lamps for a period of one year following the Date of Substantial Completion.

B. At Date of Substantial Completion, replace lamps in lighting fixtures which are observed to be noticeably dimmed after CONTRACTOR'S use and testing, as judged by OWNER.

C. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING AND CLEANING

A. Clean interior of lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses, louvers, and cones. If fingerprints and smudges cannot be cleaned, the lenses, louvers, and cones shall be replaced with new.

B. Protect installed fixtures from damage during remainder of construction period.

C. Aim and adjust luminaires as indicated on Drawings.

3.4 CLEANING

A. Remove dirt and debris from enclosures.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

3.5 GROUNDING

A. Provide equipment grounding connections for interior lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Std. 486A to assure permanent and effective grounds.

3.6 DEMONSTRATION

A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units and proceed with retesting.

END OF SECTION

SECTION 26 56 00

ATHLETIC FIELD SPORTS LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section Includes:

1. Sports field lighting.
2. Poles and cross arms.
3. Contactor cabinets.
4. Pole foundations

B. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

C. The purpose of these specifications is to define the performance and design standards for the Athletic Field Sports Lighting Systems. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth by the criteria set forth in these specifications.

D. The primary goals of this sports lighting project are:

1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore the lighting system shall be designed such that the light levels are guaranteed for a period of 25 years.
2. Environmental Light Control: It is the primary goal of this project to minimize spill light and glare.
3. Life Cycle Cost: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate.

E. The work to be done under this project includes providing all equipment materials, labor and services, and performing all operations for a complete and operating system. Any work not specifically covered but necessary to complete this installation shall be provided. All equipment and wiring to be new and provided under this contract unless otherwise noted.

F. Provide and install a complete system of sports lighting fixtures and poles installed in place, including lamps, wired and connected and left in a satisfactory operating condition. At time of final approval by the Design Professional all fixtures shall be clean and any burned out lamps or ballasts replaced at no additional charge.

G. Contractor shall furnish and install a complete and fully working sports lighting lighting system with all necessary components, accessories, lamps, ballasts, contactor cabinets, and controls in accordance with the manufacturer's recommendations to meet the specifications and design intent herein. It is the responsibility of the Contractor to ensure all necessary equipment, specialties, and appurtenances are included regardless of the product specification.

1.3 DESIGN CRITERIA

A. Lighting Performance

1. The manufacturer shall supply equipment to meet or exceed the minimum performance criteria as described below.

B. Lighting Levels

1. The performance criteria for the playing field require lighting equipment, which will provide average maintained illumination in foot-candles (fc) and uniformity ratios as specified in the chart below utilizing Metal Halide fixtures as follows:

Area of Lighting	Average Constant Light Levels	Max to Min Uniformity Ratio	Grid Points (Min)	Grid Spacing (Max)	Lamp (W)	LLF
Football						
- Field	50	2.5:1	72	30'	1500	0.72
- Track	30	2.5:1	46	30'	1500	0.72
Baseball						
- Infield	50	2:1	25	30'	1500	0.72
- Outfield	30	2.5:1	109	30'	1500	0.72
Softball						
- Infield	50	2:1	25	20'	1500	0.72
- Outfield	30	2.5:1	77	20'	1500	0.72
Tennis	50	2.5:1	252	10'	1000	0.72
Soccer	50	2:1	77	30'	1500	0.72
Bleachers	5 (Spill)	10:1	-	10'	1000	0.72

2. Bidders shall supply computer generated point-by-point lighting designs based on 1500 and 1000 watt metal halide utilizing lumens per lamp manufacturers published data. Tilt factors as published by lamp manufacturer shall be determined for each luminaire at its particular aiming angle and included in all calculations. Unique product claims that mitigate/eliminate the use of Light Loss Factor will not be considered. Only established methods of calculation as referenced in the Illuminating Engineering Society of North America (IESNA), Publication RP6-01 will be considered. Copies of IES formatted photometric data must be made available for consultant verification of performance claims. Failure to provide photometric data will be cause to disallow bid, no exceptions.

3. Initial lumen output of the lamp shall be based upon lamp manufacturers' initial lumen value after 100 hours of lamp operation per ANSI standards. A minimum light loss factor of .95 must be used for initial calculations to allow for sufficient Ballast Factor, as referenced by the IESNA.

4. Average maintained illumination shall be determined by using a maximum light loss factor of .72 calculated per the Illuminating Engineering Society's (I.E.S.) RP-6-01 sports lighting practices (LLF = LLD x BF x LDD x LTF).

5. Uniformity:

   a. Maximum / minimum ratio: The maximum to minimum ratio shall not exceed (see above chart) on the playing field.

   b. Mounting Heights: For proper uniformity and design, luminaire-mounting heights shall be as indicated on the drawings measured above the playing surface.

6. Bleacher spill coverage:

   a. The design shall include illumination of the adjacent bleachers. This can be achieved by either spill over from the fields/Track or dedicated luminaires directed towards seating areas. In no case shall the allocated wattages per pole be increased by 10%.

7. The fixture schedules shown on the drawings are preliminary and to be used as a guide in conjunction with these specifications. The basis of design is Hubbell SportsLiter solutions which establishes pole locations, heights, and maximum wattage per pole. When preparing your bid, alternate manufacturers are to use the same pole locations and heights as shown. Minor adjustments to locations and quantity of luminaires per pole will be coordinated after award of contract.

C. Environmental / Trespass Light Control:

1. To minimize light trespass, horizontal footcandles (fc) and maximum spill light levels shall not exceed the following criteria. These levels shall be tested as initial fc. (per lamp manufacturer standards, initial is after a 100 hour burn in period) and shall be measured 36" above grade at the designated distances from the boundary (side lines, end lines, foul lines and outfield radius) of the playing field **in any direction**. Maximum spill shall be calculated at every test point by aiming the meter face toward each group of luminaires and recording the highest footcandle level read. Computer analysis should indicate this maximum spill level.

Distance from Boundary		Horizontal Fc.	Maximum Spill Fc.	Spacing of Test Points
150’	Max. fc	0.5	2.8	267
	Avg. fc	0.1	0.5	267

2. Internal faceted louvers and an external visor shall control spill and glare. External visor shall be painted black and attached to the lens ring system. Internal louvers shall not interfere with re-lamping. No portion of the lamp arc tube shall be directly visible beyond 13° above and 35° to either side measured from the center axis line of the luminaire optical opening.

3. To ensure maximum glare control during the design process, the following design rule must be followed. When aimed, the upper limit of the defined beam (field angle) shall not be more than 80^0 above nadir (10^0 or more downward from the horizontal plane of the luminaire). No more than 5% of the quantity of luminaires used in a lighting project should violate this rule.

D. Testing and Measuring Spill Light

1. Ambient light levels must be measured at the designated test points as provided on the manufacturer’s computer analysis and recorded. These ambient levels must be subtracted from each spill light reading after they are recorded to obtain true spill levels for the lighting system being analyzed.

2. Spill light measurements shall be taken at test points described in the above paragraph.

3. Testing equipment for measuring footcandle levels shall be Minolta Model T-1 illuminance meter or equal. Meter must show proof of calibration as required by its manufacturer and display to .01.

4. After all footcandle tests are completed, a final report shall be provided to the owner of the project. This report should indicate footcandle levels taken on the playing field and spill locations (including and deducting ambient light levels at spill locations).

1.4 FIELD INSPECTION

A. Testing and Computer Analysis: All Testing and Computer Analysis shall generate values based upon the grid size and number of target points per LM-5, the IESNA guide for photometric testing of area and sports lighting installations. (see chart above for minimum requirements)

B. The light meter shall be in a horizontal position 36” above the playing surface for field measurements.

C. To evaluate the actual performance of the installation, illumination measurements should be made on the field using the grids and number of tests points as indicated on the lighting designs. These readings should be taken with the owner or their representative present.

D. Final Approval

1. The manufacturer’s representative shall provide a final report from the test results that shall provide the following items.

2. Identification of number and location of the test grid.
3. Actual horizontal foot-candle readings taken at ach test grid.
4. Number of hours of operation.
5. Maximum to minimum ratios.
6. Date and time of test.
7. Description of weather.

1.5 WARRANTY

A. Each manufacturer shall supply a signed warranty covering the entire system for 25 years. Warranty shall guarantee light levels; lamp replacements; system energy consumption; maintenance and control services, spill light control, and structural integrity. Warranty may exclude fuses, storm damage, vandalism, abuse and unauthorized repairs or alterations. Group lamp replacements for constant light systems must occur in accordance with the independent test report provided by the manufacturer; alternate systems must re-lamp every 2100 hours.

1.6 COMPLIANCE TO SPECIFICATIONS

A. Acceptance of manufacturers other than the Basis of Design does not negate the contractor and lighting manufacturer’s responsibility to comply fully with the requirements of these specifications.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 MAINTENANCE MATERIALS

A. Furnish stock or replacement lamps amounting to 10%, but not less than 32 lamps in each case, of each type and size lamp used in each type fixture. Deliver replacement stock as directed to OWNER'S storage space. Submit in writing to Engineer that the lamps have been delivered to the OWNER.

B. Furnish ten of each ballast type.

PART 2 PRODUCTS

2.1 ATHLETIC FIELD LIGHTING SYSTEM

A. Manufacturers:

1. Hubbell Lighting, Inc. (SportsLiter Basis of Design)
2. Musco
3. Lithonia

B. General Description:

1. The lighting system shall meet the performance requirements herein. The system shall be provided by the manufacturer and consist of remote ballast enclosure(s), pre-aimed and pre-wired socket housings on galvanized steel crossarms, optical reflectors and factory wiring harness, and remote contactor cabinets.
2. All components shall be designed and manufactured as a system. All luminaires, wire harnesses, ballast and other enclosures shall be factory assembled, aimed, wired and tested.
3. All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated for protection against corrosion and stress corrosion cracking. All wiring shall be enclosed within the crossarms, pole, or electrical components enclosure.
4. All luminaires shall be constructed with a die-cast aluminum housing or external hail shroud to protect the luminaire reflector system.
5. Manufacturer will remote all ballasts and supporting electrical equipment in aluminum enclosures mounted approximately 10’ above grade. The enclosures shall include ballast, capacitor and fusing for each luminaire.
6. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.

C. Ballasts:

1. Each ballast enclosure will be constructed of.080" thick 5052-H32 aluminum for high corrosion resistance and thermal conduction. The enclosure shall be painted with a minimum of 2 mils of polyester powder coating. A two-compartment design shall be included to isolate ballast and capacitor for cooler operation. Enclosure shall include galvanized steel hinges, lockable stainless steel latches, gasketing, and water tight wire entry. Each enclosure shall be labeled with pole location for easy reference and UL listed for 550C ambient operation.
2. Ballast shall be peak-lead autotransformer for use with 480 volt supply. Capacitors shall be 32Uf, as required by the ballast manufacturers. Dimming or reducing lamp lumens through capacitance switching will not be allowed due to the detrimental effect

on lamp stability and other factors as identified in the National Electrical Manufacturers Association publication LSD14-2002.

3. Provide a safety disconnect switch per circuit for each pole structure. Disconnect switch be located in the remote ballast enclosure.

D. Lamps:

1. The lamps shall be 1000 and 1500 watt Metal Halide and shall meet ANSI designation M48 and be manufactured to current industry standards. The lamps used must be commercially available through local electrical distribution. Approved lamp manufacturers are GE, Philips, and OSI/Sylvania. The fixture manufacturer shall submit the names, addresses and telephone numbers of three local lamp suppliers with the submittal package. Double ended or off axis arc tube lamps are not acceptable.

E. Crossarm Assembly:

1. Crossarm Assembly Shall be pre-wired to a UL listed or recognized quick connector. Each crossarm shall be labeled with pole location for easy installation. All wiring shall be completely enclosed within the crossarm assembly. For ease of maintenance, system must be capable of re-lamping from the front or rear of the assembly. The crossarm assembly must be field adjustable +11 degrees after installation to guarantee square to the field and eliminate the need to re-aim each individual fixture in the event of installation variance.

2. A factory manufactured wiring harness shall be provided. Each harness shall have top and bottom quick connect plugs and labeled for connection at each crossarm and ballast enclosure. The harness shall be matched to luminaire quantity, wattage and pole length. For added protection, the harness shall be completely wrapped with convoluted tubing. The tubing shall be polyethylene type and rated at -40^0F minimum and 200^0F maximum.

F. Optical Assembly:

1. The optical assembly shall consist of a one-piece parabolic spun aluminum Anodal® finished reflector. Lamps shall be standard 1500-watt metal halide lamps available from local suppliers. Exclusive and proprietary lamps will not be accepted. Each optic shall be filtered for optimum performance throughout the life of the luminaire. The fixture manufacturer must manufacturer the reflector.

G. Safety:

1. For safety, the system components shall be UL listed and CSA NRTL/C certified. This shall include the socket housing, remote ballast enclosure, crossarm assembly, wiring harness, junction box and optical reflectors. This system shall be approved under UL1598 and CSA 22.2 No. 9.0 or Binational std. UL 1598/CSA 250. C

2.2 POLE REQUIREMENTS

A. Structural Design:

1. Poles should be designed for the combined effects for both wind and dead load. These loading effects shall be used to determine the maximum allowable loading capacities.

B. Pole Shaft

1. Each pole shaft shall be made of a single ply steel sheet. This steel sheet shall be formed into a tubular shape with one or more longitudinal welds; circumferentially welded splices are not permitted. This tubular shape has a cross-section, which is either multi –sided or round. Multi-sided shall not have a bend radius of less than 2” and do not have a cross-section with less than 12 sides. The material used for these sections shall meet the requirements of ASTM A572 or ASTM A595 Grade-A.

2. Poles exceeding 50 feet in length must be designed as two-piece assemblies. These two-piece assemblies are joined together by telescoping the upper section over the lower section and shall be designed to lap a minimum distance of 1.5 times the inside assembly diameter. Each shaft shall have a galvanized coating in accordance with the requirements of ASTM A123 and shall be completely coated inside and out with a single dip. Double dipping shall not be permitted in compliance with USGA (United States Galvanizing Association) recommended practice.

C. Base Plate and Anchor Bolts

1. Base plates shall be integrally welded to the bottom pole section with either a telescopic weld or a full penetration weld with a back up bar. All bolt holes shall be circumferentially slotted to allow for + 2.5 degrees rotation for field adjustment. The material used will conform to either ASTM A36 or ASTM A572.

2. Anchor bolts shall meet the requirements of ASTM F1554, Grade 55. The bolts shall have a minimum threaded length of at least 6 inches and are galvanized for a minimum of 12” on the threaded end to the requirements of ASTM A153. Each bolt shall be supplied with two hex nuts and two flat washers. Each bolt shall have a “hooked” end on the embedded portion to assist in the development of pull-out-strength.

D. Hand Holes

1. Hand holes shall be peripherally reinforced with a lat bar that is integrally welded to the pole shaft. Each pole shall have a 4” x 6.5” reinforced hand hole located 18” above the finished grade. Cover plates shall be included with all hand holes and must be attached to the pole with a back-bar and screw.

E. Welding

1. All welding shall be performed by AWS (American Welding Society certified welders and all welds comply with the most recent addition of the AWS Structural Welding Code.

F. Shipping

1. Pole structures shall be shipped by truck and shall be firmly secured and packed to assure protection to the structures and finish.

G. Erection and Handling

1. Qualified personnel, utilizing equipment that is designed for handling and erection procedures of this nature, shall perform transportation and handling on job site.

H. Pole location tolerance is ± 5'.

1. The pole, when loaded with the fixture quantity specified, shall be rated for 120 mph winds.

2.3 FOUNDATION

A. The Lighting Manufacturer shall provide foundation design for the specific pole heights. An independent Professional Engineer licensed in the State of Delaware shall produce signed & sealed pole foundation designs. Lighting Manufacturer employees will not be allowed to develop foundation designs to protect the owners' interests in regards to safety.

B. A Geotechnical report shall be provided to the lighting manufacturer, by owner, with the following information:

1. Soil boring to 25-foot depth (unless rock is encountered) at each pole location with the following information;
2. Soil types, USCS groups
3. Standard penetration test
4. Soil density
5. Rock quality designation, if rock
6. Rock classification
7. Sulphate concentration
8. Ground water elevation
9. Plastic limit and plastic index
10. Site map showing grade changes across parcel and any close structures to proposed poles.
11. On soil boring 200' of linear distance is recommended.

C. Typical or Rule-of-Thumb foundations will not be acceptable. An independent Professional Engineer per the soil bore test and pole reaction information must design foundations.

D. The bidding contractor shall obtain the Geotechnical report from Owner prior to submitting bid.

E. Foundation design will be based on 2009 IBC, 120 mph, Exposure C., 1.0 Importance Factor.

F. Structural Design: The stress analysis and safety factor of the poles shall conform to AASHTO 2001 (LTS-4) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

G. Soil Conditions: The design criteria for these specifications are based on soil design parameters as outlined in the geotechnical report. If a geotechnical report is not provided by the owner, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2009 IBC, Table 1806.2.

H. It shall be the contractor's responsibility to notify the owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated.

I. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.

2.4 BASE FOUNDATION DESIGN

A. The base foundation design shall be a poured in place foundation that has been designed by a licensed professional structural engineer, registered in the State of Delaware. The poured in place foundation shall utilize anchor bolts as describe above.

2.5 ALTERNATE BASE DESIGN

A. Pre-stressed concrete base embedded in concrete backfill allowed to cure for 12-24 hours before pole stress is applied. To alleviate concerns of corrosion at or near grade level and to curtail the need for corrosion inspections and maintenance in the same area, direct burial steel poles will not be permissible.

B. The base foundation design shall be designed by a licensed professional structural engineer, registered in the State of Delaware

2.6 CONTROLS

A. Each pole shall be independently controlled through the Lutron central lighting control system. Contractor shall expand the existing Lutron system and provide all lighting network interfaces, relays, control stations, wiring, etc. for a complete functional system that can be remotely controlled by the existing system located in the High School building.

2.7 CONTACTOR CABINETS

A. Contactor cabinet to provide on-off control of the lighting system, constructed of NEMA Type 4 aluminum. Cabinet shall contain custom configured 60A contactor modules, labeled to match field diagrams and electrical design. Manual Off-On-Auto selector switches shall be provided.

B. Control coil voltage shall be 120 volt. Contractor shall provide a control branch circuit from local panelboard, through the Lutron relay panel, to each contactor.

C. Dimensions: 24” wide x 12” deep. A minimum of (8) eight contactors shall be installed in a single cabinet.

2.8 LIGHTNING PROTECTION

A. All structures shall be equipped with lightning protection meeting NFPA 780 standards. Contractor shall supply and install a ground rod of not less than 5/8” in diameter and 8’ in length, with a minimum of 10’ embedment. Ground rod should be connected to the structure by a copper main down conductor with a minimum size of #2 for poles with less than 75’ mounting height and 2/0 for poles with more than 75’ mounting height.

2.9 ELECTRIC POWER REQUIREMENTS

A. Electric power: 480 volt, 3 phase.

B. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA RP-6-01, Appendix B.

B. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles, uniformity ratios, and maximum kilowatt consumptions are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be liable to any or all of the following:

1. Manufacturer shall at his expense provide and install any necessary additional fixtures to meet the minimum lighting standards. The Manufacturer shall also either replace the existing poles to meet the new wind load (EPA) requirements or verify by certification by a licensed structural engineer that the existing poles will withstand the additional wind load.

2. Manufacturer shall minimize the Owner's additional long term fixture maintenance and energy consumption costs created by the additional fixtures by reimbursing the Owner the amount of $1,000.00 (one thousand dollars) for each additional fixture required.

3. Manufacturer shall remove the entire unacceptable lighting system and install a new lighting system to meet the specifications.

C. The Contractor shall coordinate the lighting fixture installation with all other trades.

D. Upon completion of work, the Contractor shall clean light fixtures and lenses. Equipment shall be adjusted to direction by Design Professional. All systems shall be tested to satisfaction of Owner.

E. Contractor shall be responsible for final targeting of light fixtures under the observation, and according to the recommendations of the Design Professional. Aiming shall take place after dark at a mutually agreed upon time. All costs associated with this effort shall be included in the base bid. Aiming must take place after the project's amenities have been installed. Amenities shall include but not necessarily be limited to plantings, furniture, artwork, graphics, and signage. Contractor shall include in the base bid, provisions for lifts, scaffolding, ladders, and other materials required to complete these adjustments.

END OF SECTION

SECTION 28 31 10

FIRE ALARM SYSTEM EXPANSION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and applicable sections of Division 00 – Procurement and Contracting Requirements and Division 01 – General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 REFERENCES

1. NFPA 72 - National Fire Alarm Code.
2. NFPA 92A - Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences 2006 Edition.
3. NFPA 92B - Standard for Smoke Management Systems in Malls, Atria, and Large Spaces 2005 Edition.
4. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
5. NFPA 70 National Electrical Code
6. NFPA 90A Standard For The Installation of Air Conditioning and Ventilating Systems
7. NFPA 101 Life Safety Code
8. FM Global (Factory Mutual (FM)):FM Approval Guide
9. UL Fire Protection Equipment Directory
10. UL Electrical Construction Materials Directory
11. UL 38 – Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems
12. UL 228 – Door Holding Devices
13. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
14. UL 268A - Smoke Detectors for Duct Application
15. UL 464 - Audible Signal Appliances
16. UL 497A – Secondary Protectors for Communications Circuits
17. UL 521 - Heat Detectors for Fire Protective Signaling Systems
18. UL 864 - Control Units for Fire Protective Signaling Systems
19. UL 1076 – Security
20. UL 1283 – Electromagnetic Interference Filters
21. UL 1449 - Transient Voltage Surge Suppressors
22. UL 1480 - Speakers for Fire Protective Signaling Systems
23. UL 1971 - Signaling Devices for the Hearing Impaired
24. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.

25. Equipment and labor not specifically referred to herein or on the plans, but which are required by the codes and standards, shall be provided without additional cost to the Owner.

1.3 SCHEDULES

A. Provide a schedule of the work indicating the following:

1. Intended sequence of work items.
2. Start dates of individual work items.
3. Duration of individual work items.
4. Planned delivery dates for major materials and equipment and expected lead times.
5. Milestones indicating possible restraints on work by other trades or situations.
6. Provide weekly written status reports indicating work completed and revisions to expected delivery dates. Include an updated project schedule and number of workers on the project.

1.4 DEFINITIONS

A. ASME: American Society of Mechanical Engineers
B. FACP: Fire alarm control panel.
C. FM: FM Global (Factory Mutual)
D. Furnish: To supply the stated equipment or materials.
E. Install: To set in position and connect or adjust for use.
F. LED: Light-emitting diode.
G. NCC: Network Command Center
H. NFPA: National Fire Protection Association. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
I. NICET: National Institute for Certification in Engineering Technologies.
J. Provide: To furnish and install the stated equipment or materials.
K. UL: Underwriters Laboratories

1.5 SUMMARY

A. This specification describes the expansion of the existing High School Building EST Fire & Safety fire alarm system. The expansion shall cover each remote field house and maintenance building.

B. Provide new fire alarm system panels in the remote buildings with network connection back the existing system. Contractor shall obtain the cable lengths back to the existing system to determine the type of communication. Provide fiber optic communications where cable lengths preclude the use of copper wiring.

C. Provide all required software changes and modifications to the existing system equipment to monitor and control the new fire alarm systems in the remote buildings.

D. Activation of the remote building(s) fire alarm system shall:
1. Sound alarm and activate visible notification in the affected building only.
2. Send supervisory signal to existing High School building fire alarm system.

3. Report alarm to central station either through the remote building panels or from the central system.
4. The control panel shall be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.

E. The Contractor shall give all necessary notices, obtain all permits, and pay all governmental taxes, fees, deposits, and other costs in connection with his work. He shall file all necessary plans, prepare all documents, and obtain all required Certificates of Inspection and Approval for his work, including those for occupancy.

F. The Contractor shall include in his work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings, in addition to Contract Documents, in order to meet the functional intent and comply with all applicable Codes, Laws, Ordinances, Rules and Regulations, whether or not indicated in the Construction Documents.

G. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to central station and Owner's remote monitoring system.

H. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.

I. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years.

J. The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.

K. In the interest of job coordination and responsibilities the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests.

L. General Requirements:

1. The control panel shall be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques and voice evacuation.
2. The system shall be in full compliance with National and Local Codes.
3. Weatherproof audible/visual device on the exterior of the building.
4. Manual fire alarm boxes (pull stations) not more than 5 feet from entrance to each exit. The height of the pull stations shall be a minimum of 42" and a maximum of 48", measured vertically, from the floor level to the activating handle.
5. Provide audible alarms in all areas of the building. The audible alarm notification devices shall provide a sound pressure level of 15 dBA above the average ambient sound level or 5 dBA above the maximum sound level having a duration of at least 60 seconds, whichever is greater, in every space within the building. Minimum sound pressure level

shall be 70 dBA, except for Mechanical Equipment Rooms which shall be minimum 90 dBA.

6. Provide visible alarm notification appliances (strobes) in the following areas:
   a. Public and common areas
   b. Employee work areas
   c. Each Toilet Room
   d. Common corridors
   e. Equipment Rooms
   f. Classrooms and Laboratories
7. Provide two independent telephone lines (dial tone) to the fire alarm system for central station monitoring of alarm, trouble, and supervisory conditions will be provided.
8. Smoke detectors to be provided throughout the building.
9. Duct mounted smoke detectors to be located in all supply and return air ductwork.
10. The system will be networkable.
11. NAC panels will be provided to power the notification devices.
12. Batteries shall be sized for 15 minutes of alarm at full load after 24 hours of system standby.
13. Provide all magnetic door holders.

1.6 SYSTEM DESCRIPTION

A. The system shall be a complete, electrically supervised fire detection and notification system, with a microprocessor based operating system having the following capabilities, features, and capacities:
   1. Support of mobile test system capable of providing point test reports in NFPA standard format without manual report entries.
   2. The control panel shall allow control and monitoring from a wireless handheld display device during maintenance, inspection and troubleshooting tasks.
   3. System shall provide an output port for monitoring purposes by external systems. Communications to an external system shall be RS-232 or RS-485 communications.
   4. Communications between network nodes, each supporting an interactive, self-standing, intelligent local control panel, with system wide display. Any network node shall be capable of supporting a local system in excess of 4000 input/output points.
   5. The local system shall provide status indicators and control switches for all of the following functions:
      a. Audible and visual notification alarm circuit zone control.
   6. Each intelligent addressable device or conventional zone on the system shall be displayed at the Central Alarm Receiving Terminal and the local fire alarm control panel by a unique alphanumeric label identifying its location.

1.7 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with NFPA 72 and all contract documents and specification requirements.

B. System shall be a complete, supervised, noncoded, addressable multiplex fire alarm system conforming to NFPA 72.

C. The system shall have Style 4 circuits.

D. The system shall provide the following functions and operating features:

1. The FACP and auxiliary power panels shall provide power, annunciation, supervision and control for the system.
2. Provide Class B initiating device circuits.
3. Provide Style 7 signaling line circuits for the network.
4. Provide Class B notification appliance circuits. Arrange circuits to allow individual, selective, and all-call visual notification by zone. Notification Appliance circuits shall be zoned to correspond with the building fire barriers and other building features.
5. Strobes shall be synchronized throughout the entire building.
6. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.

E. The system shall provide a field test function where one person can test the complete system or a specific area while maintaining full operational function of other areas not being tested. Alarms, supervisory signals, trouble signals shall be logged on the system printer and in system history during the walk-test.

F. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

G. Fire alarm signal initiation shall be by one or more of the following devices:

1. Manual pull station
2. Heat detector
3. Addressable area smoke detector
4. Duct smoke detector

H. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications at all network Person Machine Interfaces using basic graphics and multiple detail screens.

1. Fire Alarm Condition:
   a. Sound an audible alarm and display a custom screen/message defining the building in alarm and the specific alarm point initiating the alarm in a graphic display.
   b. Log into the system history archives all activity pertaining to the alarm condition.
   c. Print alarm condition on system printer.

d. Sound the ANSI 117-1 signal with synchronized audibles and synchronized strobes throughout the facility.

e. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.

f. The alarm information shall be displayed on the existing Graphic Annunciator.

g. System operated duct detectors as per local requirements shall accomplish HVAC shut down.

h. Door closure devices shall operate by floor or by local requirements.

2. Supervisory Condition:

a. Display the origin of the supervisory condition report at the local fire alarm control panel graphic LCD display and at the existing remote annuciator.

b. Activate supervisory audible and dedicated visual signal.

c. Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.

d. Record within system history the initiating device and time of occurrence of the event.

3. Trouble Condition

a. Display at the local fire alarm control panel graphic LCD display and at the existing remote annuciator.

b. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.

c. Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.

d. Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not preclude the logging of trouble events to the historical file.

e. Trouble reports for primary system power failure to the master control shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.

f. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

I. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1.8 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Complete manufacturer’s catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.

B. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement. Provide the following supporting information:

1. Supervisory power requirements for all equipment.
2. Alarm power requirements for all equipment.
3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.
4. Voltage drop calculations for wiring runs demonstrating worst-case condition.
5. NAC circuit design shall incorporate a 15% spare capacity for future expansion.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Complete drawings covering the following shall be submitted by the contractor for the proposed system:
   a. Floor plans in a CAD compatible format at a scale of 1/8”=1’-0” showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
   b. Provide a fire alarm system function matrix as referenced by NFPA 72, Figure A-7-5.2.2 (9). Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.
4. Installation drawings shop drawings, and as-built drawings shall be prepared by an individual experienced with the work specified herein.
5. Incomplete submittals shall be returned without review, unless with prior approval of the Engineer.

D. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Light fixtures.
2. HVAC registers

E. Qualification Data: For qualified Installer, Applicator, manufacturer, fabricator, professional engineer, testing agency, and factory-authorized service representative.

F. Source quality-control reports.

G. Field quality-control reports.

H. Operation and Maintenance Data: For all fire alarm equipment, to include in operation and maintenance manuals.

I. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

J. Warranty: Sample of special warranty.

1.9 QUALIFICATIONS

A. Supplier Qualifications

1. Wayman Fire Protection, Inc.

B. Installer Qualifications:

1. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified.
2. The contractor shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.
3. The contractor shall employ on staff a minimum of one NICET level IV technician or a professional engineer, registered in the State of the installation.
4. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.

C. Testing Agency Qualifications: Qualified for testing indicated.

D. Source Limitations for fire alarm equipment: Obtain fire alarm equipment from single source.

E. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.
3. Combustion Characteristics: ASTM E 136.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Preinstallation Conference: Conduct conference at Project site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.11 PROJECT CONDITIONS

A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.

B. Environmental Limitations: Do not deliver or install products or materials until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire alarm equipment that fail(s) in materials or workmanship within specified warranty period.

B. Warranty Period: 5 years from date of Start-Up and Commissioning.

1.13 SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for 5 years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

C. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.14 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents as follows:

1. Pluggable LED’s for Remote Indicating Panels: Furnish quantity equal to 20 percent of the number of units installed.
2. Speaker/Strobe and Strobe Units: Furnish quantity equal to 5 percent of the number of each units installed.
3. Smoke Sensors and Heat Detectors: Furnish quantity equal to 5 percent of the number of units of each type installed.
4. Sensor Bases: Furnish quantity equal to 2 percent of the number of units of each type installed.
5. Control and Relay Module: Furnish quantity equal to 5 percent of the number of units of each type installed.

1.15 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

PART 2 PRODUCTS

2.1 FIRE DETECTION AND ALARM

A. Manufacturers:
   1. EST Fire & Security (Existing High School Building System)

2.2 CONTROL PANEL

A. The fire alarm control panel shall be microprocessor based using multiple microprocessors throughout the system providing rapid processing of smoke detector and other initiation device information to control system output functions.

B. There shall be a watchdog circuit, which shall verify the system processors and the software program. Problems with either the processors or the system program the panel shall activate a trouble signal, and reset the panel.

C. The system modules shall communicate with an RS 485 network communications protocol. All module wiring shall be to terminal blocks, which will plug into the system card cage. The control panel shall be capable of expansion via up to 100 SLCs. Maximum system capacity shall be at least 2500 intelligent initiation devices.

D. System response time from alarm to output shall not exceed three (3) seconds.

E. To expedite system troubleshooting, the system cards shall have ground fault detection, and diagnostic LED’s by card.

F. All system cards and modules shall have Flash memory for downloading the latest module firmware.

G. Networking:
   1. Digital communication capabilities supporting Style 7 (Class A) communications using either DC digital or fiber optics technologies or combinations of both as required for the control panel to communicate with at least 50 remote transponders.
   2. Digital communication capabilities supporting Style 7 (Class A) communications using either DC digital or fiber optics technologies or combinations of both as required for the control panel to communicate with at least 59 network nodes.
   3. Capability shall exist within the system to extend the network at any node. The system shall support a maximum of two network extension circuits in series on any system branch, extending the inherent distance limitations for network communications.

4. Communication protocol shall be of the CSMA/CD (carrier sense, multiple access, collision detect) type, eliminating delays incorporated into other protocols. Communication techniques using token passing and requiring sensing of delays and re-generation of the token to re-establish network communications in the event of a fault shall not be acceptable.

H. Software Modifications: The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made. Systems that require the use of external programmers or change of EPROMs are not acceptable.

2.3 POWER SUPPLY

A. The system Power Supply/Charger (PSC) shall be a 12-amp supply with battery charger. The power supply shall be filtered and regulated. The power supply shall have a minimum of 1 power limited output rated at 4 amps, and a minimum of 1 output rated at 12 amps. The system power supply can be expanded up to 48 amps. The auxiliary power supply module shall share common batteries with the primary power supply. The system power supply shall have 4 relays, 1 for common alarm, one for common trouble and two programmable relays. The power supply shall be rated for 120/240 VAC 50/60 Hz.

B. The battery charger shall be able to charge the system batteries up to 100 AH batteries. Battery charging shall be microprocessor controlled and programmed with a special software package to select charging rates and battery sizes. Provide thermistor for monitoring battery temperature to control charging rate.

C. The power supply shall have a plug for an AC adapter cable, which allows a technician to plug in a laptop computer for up or down loading program information or test equipment.

D. Transfer from AC to battery power shall be instantaneous when AC voltage drops to a point where it is not sufficient for normal operation.

2.4 SYSTEM ENCLOSURE

A. Provide the enclosure needed to hold all the cards and modules as specified with at least spare capacity for two cards. The enclosure outer door shall be either black or red. Provide the color as to the local AHJ requirements. The outer doors shall be capable of being a left hand open or a right hand open. The inner door shall have a left hand opening. System enclosure doors shall provide where required ventilation for the modules or cards in the enclosure.

B. Provide system enclosure for all amplifiers. Where required by the manufacturer, provide means for venting heat from the enclosure either by having enclosure sides and top vented or the doors vented.

2.5 INITIATING DEVICES

A. Intelligent Initiation Devices – General

1. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections on either Style 4 or Style 6 circuits.

B. Smoke Detectors – Addressable

1. The detector shall be guaranteed in writing not to false alarm when configured by the factory trained certified technician. The detector must provide up to 11 different environmental algorithms that allow the detector to provide superior false alarm immunity without the need for additional alarm verification delays.

2. The detector shall have a multicolor LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for maintenance required, red for alarm.

3. The multi-criteria smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. So as to minimize the effort required by the installing and maintenance technician to appropriately configure the detector to ensure optimal system design, the detectors shall be programmable as application specific. Application settings shall be selected in software for a minimum of eleven environmental fire profiles unique to the devices installed location.

4. The detector shall be designed to eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report.

5. The intelligent smoke detector shall be capable of providing three distinct outputs from the control panel. The outputs shall be from an input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber.

6. The detector shall support the use of a relay, or LED remote indicator without requiring an additional software address. Low profile, white case shall not exceed 2.5 inches of extension below the finish ceiling.

7. Detector wiring shall not require any special shielded cable. For the detector where required, there shall be available a locking kit and detector guard to prevent unauthorized detector removal.

8. Where required, there shall be available a programmable remote lamp configurable to remotely duplicate the on-board LED status of another system device with the same software address.

9. Provide adaptor box for all surface mounted detectors including all apartments.

C. Heat Detectors – Addressable

1. Thermal Detectors shall be rated at 135 degrees fixed temperature and 15 degrees per minute rate of rise. Detectors shall be constructed to compensate for the thermal lag inherent in conventional type detectors due to the thermal mass, and alarm at the set point of 135 degrees Fahrenheit. The choice of alarm reporting as a fixed temperature detector or a combination of fixed and rate of rise shall be made in system software and be changeable at any time without the necessity of hardware replacement.

2. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet and shall be installed according to the requirements of NFPA 72 for open area coverage.

D. Duct Smoke Detectors – Addressable

1. For duct detector applications, the smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes.

2. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. The detector shall be mounted in a duct detector housing listed for that purpose. The duct detector shall support the use of a remote test switch, relay or LED remote indicator. The duct detector shall be supplied with the appropriate sampling tubes to fit the installation.

3. Where duct detectors are exposed to the weather a weatherproof enclosure shall be available. The duct housing cover shall include a test port for functional testing of the detector without cover removal. The duct housing shall include a cover removal switch capable of indicating cover removal status to the fire alarm control panel.

4. The intelligent duct detector shall have a duct housing with an on-board relay. Also where required, there shall be a standalone housing available with its own power supply and test/reset switch that does not require connection to a fire alarm control panel.

5. Provide all control wiring, devices, and relays to shutdown the associated mechanical equipment.

6. Provide remote test switch with LED indicator.

7. Provide 120V branch circuit from normal/emergency source.

E. Detector Bases – Addressable

1. Detector bases shall be low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on an industry standard, 4" square or octagonal electrical outlet box.

2. Where selective localized control of electrical devices is required for system operation, furnish and install detector base with software programmed addressable relay integral to the base. The relay shall switch electrical loads within relay ratings, as indicated on the drawings. Operation of the addressable control circuit shall be independent of the number of detectors and relays on the circuit or the number in an alarm state. Relay bases shall be rated for resistive or inductive load (120VAC or 30VDC) 3 amps.

3. Where indicated on the drawings, furnish detector base with integral approved audible evacuation alarm signal having an output of 85db @ 10’. The audible signal shall be individually addressable and software programmed for operation.

F. Manual Pull Stations – Addressable

1. Provide addressable manual stations where shown on the drawings, to be flush or surface mounted as required. Manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel. The manual station communications shall allow the station to provide alarm input to the system and alarm output from the system within less than four (4) seconds.

2. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer's prescribed matching red enamel outlet box.
3. Pull station shall be double action.
4. Where required provide pull stations capable of explosion proof installation, capable of weatherproof installation, two stage operation, reset key operation, and metal housings.

G. Addressable Interface Devices

1. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive.
2. Where needed a Conventional Zone Module shall connect to the Signal Line Circuit, which will allow the use of conventional initiation devices. This module shall have the ability to support up to 15 convention smoke detectors and an unlimited number of contact devices. This module shall also be capable of monitoring Linear Beam detectors and conventional Flame detectors.
3. Fire Alarm Control Module – Provide addressable intelligent control modules to provide independent control of the apartment strobes and like functions. The module shall be microprocessor based and programmed as an independent, remotely located NAC or similar circuit. The module shall communicate through the SLC and be provided with a supervised 24VDC input. Mount in a standard backbox with coverplate.
4. Fire Alarm Monitor Module – Provide addressable device interface (monitor) modules to assign a unique address and supervision of sprinkler system, generator status, fire pump status, NACP trouble, and like functions. Modules shall be microprocessor based with bi-directional communication. Mount in standard backbox with coverplate.
5. Fire Alarm Relay Module – Provide addressable device interface relay modules to control the elevators, door hold-open devices and like devices. Relay shall be addressable and controlled independently by the control panel. Mount in standard backbox with coverplate.
6. Line Isolation Module – Provide line isolation modules for protection of short circuits on intelligent device circuits. When a short circuit is detected, the module shall isolate the affected segment of the circuit, allowing the remaining devices to continue operation. The module shall be self-restoring. Mount in a standard backbox with coverplate.
7. Single Device Damper Monitoring and Control: When connected to the FACP, a single switch input shall be able to monitor all 3 states of a damper – open, closed, and in transit. When connected to a FACP, a single relay shall be able to fully control a damper (through the relay connected to the motor control) while also using its switch input for monitoring all 3 states of the damper.

2.6 NOTIFICATION APPLIANCES

A. Strobes

1. Visual-notification appliances shall meet and be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service
2. Strobe shall be listed for indoor use, and shall meet the requirements of FCC Part 15 Class B
3. Strobe appliances shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range, and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens
4. All inputs shall be compatible with standard, reverse polarity supervision of circuit wiring by a Fire-Alarm Control Panel (FACP)
5. The strobe shall be of low-current design
6. The strobe intensity shall have field-selectable settings, and shall be rated per UL Standard 1971 for 15/30/75/95cd or 115/177cd for ceiling mount where Multi-Candela appliances are specified unless otherwise noted.
7. The selector switch for selecting the candela shall be tamper resistant
8. The appliance shall be compatible with sync modules and NACP power supplies with built-in sync protocol when synchronization is required
9. The strobes shall not drift out of synchronization at any time during operation
10. If the sync module or Power Supply fails to operate, (i.e. - contacts remain closed), the strobe shall revert to a non-synchronized flash rate
11. The strobes shall be designed for indoor surface of flush mounting
12. All notification appliances shall be backward compatible

B. Low Profile – Horn and Horn Strobes

1. Horn appliances and horn-strobe appliances shall be UL Listed under Standard 1480 for Fire Protective Service, and horns equipped with strobes shall be listed under UL Standard 1971 for Emergency Devices for the Hearing-Impaired
2. All inputs shall employ terminals that accept #12 to #18 AWG wire sizes
3. Strobe portion of the appliance shall produce a flash rate of one (1) flash per second, and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens
4. Strobe shall be of low-current design
5. Strobe intensity, where Multi-Candela appliances are specified, shall have field-selectable settings, and shall be rated per UL Standard 1971 for:
   a. 15/30/75/110cd (wall mount) -or-
   b. 135/185cd (wall mount)
   c. 15/30/75/95cd (ceiling mount) -or-
   d. 115/177cd (ceiling mount)
6. Selector switch for selecting the candela shall be tamper resistant

7. The strobe portion, when synchronization is required, shall be compatible with sync modules or NACP power supplies with built-in sync protocol
8. The strobes shall not drift out of synchronization at any time during operation
9. Strobes shall revert to a non-synchronized flash-rate, if the sync module or Power Supply should fail to operate (i.e. – contacts remain closed)
10. Horn and horn-strobe appliances shall be designed for indoor surface or flush mounting
11. Grille cover shall mount to standard electrical hardware requiring no additional trim plate or adapter
12. The finish of the Horns and horn-strobes shall be white.
13. All speaker and speaker-strobe appliances shall be listed for Special Applications: Strobes are designed to flash at 1-flash-per-second minimum over their "Regulated Input Voltage Range"
14. Provide weatherproof speakers/strobes as indicated on the drawings.

2.7 DIGITAL COMMUNICATOR

A. The Mulit-Point Digital Alarm Communicator (MDACT) shall be UL864 listed to provide point identification of alarm, supervisory, security and trouble events to a Central or Remove Receiving Station. The MDACT shall support the following:

1. Ademco Contact ID or SIA protocol
2. Ademco Contact ID selection shall provide the ability to transmit events for up to 999 individual points
3. SIA selection shall provide the ability to transmit events for up to 2040 individual points
4. Programming of accounts and phone numbers
5. Dual phone line interface
6. Line fault monitoring.
7. Automatic 24-hour test

2.8 NOTIFICATION APPLIANCE CIRCUIT POWER EXPANSION PANEL

A. An alarm extender panel shall be provided where needed. The power supply shall be a minimum of 6 amps. The power supply shall contain four supervised notification circuits maximum of 3 amps each circuit. The power supply shall contain built-in synchronizing modules for strobes and audibles. There shall be a 3 amp filtered auxiliary power limited output. There shall be a minimum of 8 options as to the operations of the inputs and outputs. Each panel shall be provided with its own power supply, batteries, and charger. Provide quantity of panels required to power all notification appliances regardless of general layout shown on drawings.

PART 3 EXECUTION

3.1 PROTECTION

A. Contractor shall protect all work and material from damage from its work or employees, and shall be liable for all damages thus caused.

B. Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. Contractor shall protect any material that is not immediately installed. Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

C. Project plans and specifications, including the Construction Documents for the new fire pump installation, shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

D. Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

E. Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate or if any discrepancies occur between the plans and the contractor's work, and the plans and the work of others the Contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this Specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by and at the expense of this Contractor.

F. Remove and replace devices and panel components that are wet, moisture damaged, or mold damaged.

3.2 INSTALLATION

A. Install 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors in conduit.

B. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit.

C. Mount outlet box for electric door holder to withstand 80 pounds pulling force.

D. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors and all initiating/notification devices.

E. Automatic Detector Installation: Conform to NFPA 72.

F. Manufacturer's Field Services: Required.

G. Demonstration and Training: Furnish 12 hours of instruction each for four persons, with manufacturer's representative.

H. Perform work in accordance with the requirements of NFPA 70, NFPA 72 and NECA 1-2006, Standard of Good Workmanship in Electrical Contracting.

I. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

J. Wiring Method: Install cables in conduit.

K. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

L. Provide primary power for each panel from local branch circuit panels. Power shall be 120 VAC service, transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all circuits and devices.

M. Control panels shall be identified with minimum 1/2” letters on laminated plastic nameplates.

N. Manufacturers' name plates and UL or CSA labels are to be visible and legible after equipment is installed.

O. Identifiers shall match record documents.

P. Penetration of floor slabs and fire walls/ceilings shall be fire stopped in accordance with all local fire codes.

Q. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

R. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

S. All devices and appliances shall be mounted to or in an approved electrical box.

T. Any shorts, opens, or grounds found on new or existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.

U. Contractor shall neatly tie-wrap all field-wiring conductors in the gutter spaces of the control panels and secure the wiring away from all circuit boards and control equipment components. Field-wiring circuits shall be neatly and legibly labeled in the control panel. No wiring except home runs from Life Safety System circuits and system power supply circuits shall be permitted in the control panel enclosures. No wiring splices shall be permitted in any control panel enclosure.

V. Equipment shall be attached to walls, ceiling and floor assemblies and shall be mounted firmly in place. Detectors shall not be supported solely by suspended ceilings. Fasteners and supports shall be sized to support the required load.

W. Fire detection and alarm system devices, control panels, and remote annunciators shall be flush-mounted when located in finished areas and may be surface-mounted when located in unfinished areas.

3.3 BOXES, ENCLOSURES AND WIRING DEVICES

A. Boxes shall be installed plumb and firmly in position.

B. Extension rings with blank covers shall be installed on junction boxes where required.

C. Junction boxes served by concealed conduit shall be flush mounted.

D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

E. "Fire alarm system" decal or silk-screened label shall be applied to all junction box covers.

3.4 CONDUCTORS

A. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

C. Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits; 18 AWG twisted shielded, speaker circuits; 18 AWG twisted, telephone circuit; 18 AWG twisted shielded.

D. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer recommendations.

E. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

F. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

G. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

H. Product Description: Power limited fire-protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C.

I. Fire alarm circuit conductors have insulation color or code as follows:

1. Power Branch Circuit Conductors: Black, red, white.
2. Initiating Device Circuit: Black, red.
3. Detector Power Supply: Violet, brown.
4. Signal Device Circuit: Blue (positive), white (negative).
5. Door Release: Gray, gray.
6. Municipal Trip Circuit: Orange, orange.
7. Municipal Fire Alarm Loop: Black, white.

3.5 DEVICES

A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

B. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

C. All devices and appliances shall be mounted to or in an approved electrical box.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.

C. A consistent color code for fire alarm system conductors throughout the installation.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Testing General:

1. All Alarm Initiating Devices shall be observed and logged for correct zone and sensitivity. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the initials of the installing technician and date.
2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
3. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
4. Test reports shall be delivered to the acceptance inspector as completed.
5. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:
   a. Ladders and scaffolds as required to access all installed equipment.
   b. Multi-meter for reading voltage, current and resistance.
   c. Two way radios, and flashlights.
   d. A manufacturer recommended device for measuring air flow through air duct smoke detector sampling assemblies.
   e. Decibel meter.

f. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

3.8 ACCEPTANCE TESTING

A. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the engineer in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

B. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.

C. The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.

D. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the owner and test results recorded for use at the final acceptance test.

E. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that all panel functions were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

F. Final Acceptance Test: Notify the owner in writing when the system is ready for final acceptance testing. Submit request for test at least 14 calendar days prior to the test date. A final acceptance test will not be scheduled until meggar test results, the loop resistance test results, and the submittals required in Part 1 are provided to the owner. Test the system in accordance with the procedures outlined in NFPA 72.

1. Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
2. Test each initiating and indicating device and circuit for proper operation and response. Disconnect the confirmation feature for smoke detectors during tests to minimize the amount of smoke or test gas needed to activate the detector.
3. Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturer's operating and maintenance manual.
4. Visually inspect all wiring.
5. Verify that all software control and data files have been entered or programmed into the FACP.
6. Verify that Shop Drawings reflecting as-built conditions are accurate.
7. Measure the current in circuits to assure that there is the calculated spare capacity for the circuits.

8. Measure voltage readings for circuits to assure that voltage drop is not excessive.
9. Measure the voltage drop at the most remote appliance on each notification appliance circuit.

G. The acceptance inspector shall use the system record drawings in combination with the documents specified in this specification during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
1. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
   a. Open, shorted and grounded signal line circuits.
   b. Open, shorted and grounded notification, releasing circuits.
   c. Primary power or battery disconnected.
2. System notification appliances shall be demonstrated as follows:
   a. All alarm notification appliances actuate as programmed
   b. Audibility and visibility at required levels.
3. System indications shall be demonstrated as follows:
   a. Correct message display for each alarm input at the control display.
   b. Correct annunciator light for each alarm input at each annunciator and graphic display as shown on the drawings.
   c. Correct history logging for all system activity.
4. System off-site reporting functions shall be demonstrated as follows:
   a. Correct zone transmitted for each alarm input
   b. Trouble signals received for disconnect
5. Secondary power capabilities shall be demonstrated as follows:
   a. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
   b. System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
   c. System battery voltages and charging currents shall be checked at the fire alarm control panel.

3.9 CERTIFICATE OF COMPLIANCE

A. Complete and submit to the Engineer a “Certificate of Compliance” in accordance with NFPA 72, most current edition adopted by the Authority Having Jurisdiction.

3.10 DOCUMENTATION

A. System documentation shall be furnished to the owner and shall include but not be limited to the following:

1. System record drawings and wiring details including one set of reproducible drawings, and a CD ROM with copies of the record drawings in DXF format for use in a CAD drafting program.
2. System operation, installation and maintenance manuals.
3. System matrix showing interaction of all input signals with output commands.
4. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
5. System program showing system functions, controls and labeling of equipment and devices.

3.11 DEMONSTRATION

A. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing and maintenance of the system provided. The instructor shall train the employees designated by the owner, in the care, adjustment, maintenance, and operation of the fire alarm system.

B. Training sessions shall cover all aspects of system performance, including system architecture, signaling line circuit configurations, sensor and other initiating device types, locations, and addresses, fire alarm control panel function key operation, and other functions as designated by the owner.

C. Required Instruction Time: Provide 16 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the owner. The instruction may be divided into two or more periods at the discretion of the owner. One training session shall be videotaped by the contractor. Videotapes shall be delivered to the owner.

D. Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory and trouble. The instructions shall be approved by the owner.

E. Comprehensive system troubleshooting training shall be provided for a single individual designated by the owner. This session shall be separate and distinct from the above described sessions.

F. All training sessions shall be conducted following final system certification and acceptance. Three additional training sessions shall be provided for all security personnel on all shifts six months after final system certification.

G. All training sessions shall be conducted by an authorized fire alarm system distributor representative, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided.

3.12 SERVICES

A. The Contractor shall warrant the entire system against mechanical and electrical defects for a period of two-(5) years. This period shall begin upon completed certification and test of the system or upon first beneficial use of the system, whichever is earlier.

B. The Contractor or manufacturer shall offer for the Owner's consideration at the time of bidding a priced inspection, maintenance, testing and repair contract in full compliance with the requirements of NFPA 72.

C. The Owner shall have the option of renewing at the price quoted in the bid proposal for single or multiple years up to five years.

D. The Contractor performing the contract services shall be qualified and listed to maintain ongoing certification of the completed system to the UL for specific installed system listing.

E. The Installation Contractor shall furnish training as follows for a minimum of four employees of the system user including fire department personnel.

F. Training in the receipt, handling and acknowledgment of alarms.

G. Training in the system operation including manual control of output functions from the system control panel.

H. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.

I. System integration functions and operation.

J. The total training requirement shall be a minimum of 8 hours, but shall be sufficient to cover all items specified and also to ensure seamless integration of fire alarm system to other building systems.

END OF SECTION

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, plants and grass to remain.
2. Removing existing trees and other vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place and removing site utilities.
7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 01 Section "Temporary Construction Utilities, Facilities & Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities.
2. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
3. Division 32 Section "Turf and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to approved Sediment and Erosion Control Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Construction Manager will arrange to shut off indicated on-site utilities when requested by Contractor.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Construction Manger and Owner not less than five days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Construction Manager’s written permission.

C. Excavate for and remove underground utilities indicated to be removed. Refer to sections covering site utilities.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Do not stockpile topsoil within tree protection zones.
2. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 311000

SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, any Supplementary General Conditions and Division 1, General Requirements, are hereby made a part of this Section as fully as if repeated herein.

1.2 SECTION INCLUDES

A. Earthwork includes areas below building foundations, below concrete slabs on grade, below paved areas and grading of all unpaved area in the site.

1. Layout and staking for earthwork.
2. Excavation and rough grading.
3. Erosion and sediment control.
4. Foundation excavation for footings.
5. Establishing subgrades, leveling and proofrolling.
6. Filling, backfilling and compaction.
7. Keeping streets clean of materials tracked off site.
8. Includes trenching, excavation and backfill for utilities.
9. Maintenance and/or repair of damage to the rough grading.
10. Removal and disposal of stones, debris, excess and unsuitable materials.
11. Soil treatment for termite control.
12. Field quality control, testing, and inspection.

1.3 DEFINITIONS

A. Rock Excavation: Natural geological formations or other material which cannot be removed by adequate equipment (in good condition) as defined below, shall be considered a change in the scope of work and paid for by the Owner if encountered.

1. Open Excavation and Grading: Rock in excess of the capabilities of a Caterpillar D-8 tractor (or equivalent) with 2 cu. yd. bucket and hydraulically operated single tooth power ripper.
2. Trenches, Pits and Footings: Rock in excess of the capabilities of a Caterpillar 235 Hydraulic Backhoe (or equivalent) using a 2 ft. Bucket width (3/4 cu. yd.)
3. Minimum Effort: If rock is not removed during the process of normal digging and ripping, then extend the excavation to expose the rock surface within the limit of original excavation. Contact the A/E and he may direct the sides of rock to be exposed to a depth of 3 feet. This will be to determine to the extent of additional work.

B. Earth Excavation: Anything not classified as rock including as example: soils, gravels, stones, boulders, vegetation, debris, and unsuitable materials.

C. Unsuitable Materials: All excavated materials; debris, man made or fabricated materials, concrete spoil, organic, soft, expansive, or unstable matter; all shall be disposed of as herein specified. Excessive moisture content shall not classify a material as unsuitable.

D. Removal and disposal of unsuitable material above the subgrade elevation and placement of approved specific fill material (from on or off the site) above the subgrade elevation as directed by the Soils Engineer shall be considered a part of the work.

E. Removal and disposal of unsuitable material approved below the subgrade elevation and placement of approved specific fill material (from on or off the site) below the subgrade elevation as directed by the Soils Engineer shall be considered a change in the scope of work.

F. Soils Engineer or Inspection Agency: An Agency and its designated representatives who monitor and approve all earthwork operations described herein.

G. Subgrade: The finished elevation of the earth immediately below all slabs, granular and porous fill, paving, footings, walls, etc., except the subgrade elevation shall not be higher than 12" below the existing earth elevation at the start of the project.

H. Subgrade for utility construction: Underside of barrel of pipe, or underside of any cradle or bedding if noted on drawings, or referenced in applicable local government specifications. For pipe drains and miscellaneous structures encased in concrete or on concrete, stone and/or gravel cradle, subgrade is lowest outside surface of encasement or cradle.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

K. Drainage Course: Course supporting the slab on grade that also minimizes upward capillary flow of pore water.

L. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

M. Utilities: On site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

N. Filter Material: Course placed around drainage pipes.

1.4 QUALITY ASSURANCE

A. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO).
2. American Society for Testing and Materials (ASTM).
3. Delaware Department of Transportation, State Highway Administration “Standard Specifications for Materials and Construction”, October 1993, as amended to date (M.S.H.A. as hereinafter referred). Delete references to Measurement and Payment.

B. Geotechnical Testing Agency Qualifications: An independent testing agency (with a Geotechnical engineer licensed in the state where the project is being constructed on staff) qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

C. Tolerances: As indicated herein.

D. Testing: Requirements as specified herein.

1.5 SUBMITTALS

A. Notification:

1. Notify and provide data to regulatory authorities and A/E prior to commencement of work.
2. Provide notice of: encounter with unknown utilities; subgrades before filling; areas requiring
3. testing or inspection.

B. Product Data: For the following:

1. Geotextile.
2. Detection Warning Tape.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D2487 of each on site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D1557 for each on site and borrow soil material proposed for fill and backfill.
3. Field reports; in-place soil density tests.
4. One optimum moisture – maximum density curve for each type of soil encountered.
5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.
6. Test reports must be submitted daily to the Architect and Owner.

1.6 PROJECT CONDITIONS

A. Subsurface Conditions: Subsurface soils investigations have been made at the site. The report and logs of the test borings and test pits are included in the Appendix of these specifications. Such investigations have been made for the purposes of design only and neither the Engineers, the Owner, nor the Geotechnical Engineer guarantee adequacy or accuracy of the data, or that data are representative of all conditions to be encountered. Such information is made available for general information only and shall not relieve the Contractor of the responsibility for making his own investigations, tests, and analysis. Any additional test borings and other exploratory operations may be made by Contractor shall be at no cost to Owner.

1. See Geotechnical Engineering Report prepared by Hillis Carnes Engineering Associates, Inc. in Division 1 for test boring data and other requirements.

B. Erosion and sediment control, in addition to erosion control specified in Section 31100 and Division 1:

1. Standards: Comply with the requirements of the "Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas" by the U.S.D.A. Soil Conservation Service.
2. General Erosion: Prevent erosion of earthwork; repair and correct any ditches, gullies or erosion immediately and upon occurrence.
3. Excavations: Prevent water from flowing into open excavations and toward building walls.
4. Slopes: Cover (with continuous plastic membrane) and stake all slopes steeper than 1.5 horizontal to 1 vertical.

C. Environmental Conditions:

1. Do not apply soil treatment when temperature is at or below freezing or when ground is frozen or frost is expected.
2. Do not apply soil treatment when surface water is present.

D. Existing Conditions: Accept the site in the condition which it exists at the time of the award of the contract and perform all work to the grades indicated.

1. Protect plant material, lawns and other features not designated for removal.
2. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

E. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
2. Do not interrupt existing utilities serving facilities occupied and used by others, except when permitted in writing by A/E and then only after acceptable temporary utility services have been provided. Provide a minimum of 48 hour notices to utility Owners and receive written notice to proceed before interrupting any utility.

F. Rock Excavation: Rock excavation may be performed with hoe rams, jack hammers, or any method the Contractor wishes to employ except for explosives.

1.7 PROTECTION

A. Safety: Provide protective measures necessary for the safety of workmen, to the public and adjacent property. Prevent cave-ins, collapse of walls, structures and slopes, both on and adjacent to the site.

B. Standards: Comply with regulations of local authorities having jurisdiction, including all applicable O.S.H.A. requirements.

C. Repair: Includes the removal and replacement with new materials all materials so affected by settlement.

PART 2 - PRODUCTS

2.1 FILL AND BACKFILL

A. Satisfactory Soils:

1. Compacted fill and backfill shall be free of deleterious matter such as frozen materials, organics, wood, debris, or rock larger than 4 inches in diameter and be classified SP, SW, SM, SC, GP, GC, GM, or GW per ASTM D-2487. All material shall have a liquid limit and plasticity index not exceeding 40 and 20 respectively when tested in accordance with ASTM D-4318.
2. The minimum dry unit weight shall not be less than 105 PCF maximum dry density as determined by ASTM D-1557, modified proctor.
3. All fill and backfill materials shall be obtained from on site or from off site sources and shall be approved by the Geotechnical Engineer prior to placement.
4. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with a least 90 percent passing a 1 ½ inch sieve and not more than 12 percent passing a No. 200 sieve.

1. Locations: All on site fill areas

C. Structural Fill: On-site soils free of organic material, topsoil, miscellaneous fill, debris and rock fragments in excess of 3 inches in their largest dimension may be suitable as structural fill.The granular on-site soils may be suitable for re-use as structural fill. Some of these soils have an in-situ moisture content that exceeds the typical range that would allow the recommended compaction to be achieved. Therefore, drying of these soils may be required to achieve the recommended compaction.

If sufficient quantities of suitable on-site soils are not available for structural fill, imported borrow consisting of predominately granular soils conforming to the requirements of the Delaware Department of Transportation Standard Specifications Select Borrow, Type G should be utilized or AASHTO SP-57 stone.

D. Drainage fill:

1. Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel, (ASTM D 448 Coarse - aggregate grading size 57), with 100% passing of 1-1/2" sieve and not more than 5% passing a No. 8 sieve. Aggregate shall meet DELDOT specification for No. 106A aggregate. Provide by Contractor from off site source.

   a. Locations: All concrete slab on grade areas

2. For foundation drainage, use aggregate meeting DELDOT specification for No. 113 aggregate.

   a. Locations: Drainage fill behind basement walls and retaining walls.

E. Stone Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, reclaimed concrete, and natural or crushed sand (ASTM D2490) with at least 95% passing a 1 ½" sieve and not more than 8% passing a No. 200 sieve. Provide by contractor from off site sources.

F. Subbase Material: Designation CR-6 in accordance with DELDOT Specifications.

1. Locations: All vehicular traffic areas

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1 inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve. For utility installations, bedding shall conform to AASHTO #57 stone.

H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; AASHTO M-43, size No. 17.

I. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

J. Processed Rubble Fill: Existing brick and concrete rubble, free of wood and steel may be processed by use of tracked equipment such that no particle size greater than 6 inches in the longest dimension remains.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 FILL AND BACKFILL FOR UTILITIES

A. Backfill: Earth removed from the trench provided that in the opinion of Soils Engineer such excavated material is satisfactory for backfilling.

B. Should the excavated material be considered unsatisfactory for backfilling, the Contractor shall remove and dispose of such unsatisfactory material and substitute, in lieu thereof, suitable material obtained from elsewhere on or off the site.

C. Materials shall meet the requirements specified in paragraph 2.1.A above.

2.3 TOPSOIL

A. Refer to Section 329200 Turf and Grasses.

2.4 SOIL TREATMENT - TERMITE CONTROL

A. Emulsion soil chemicals of only water-based type. Do not use any fuel oil as a diluent.

B. Solutions and chemicals listed and approved by EPA, USDA, and Delaware State Department of Agriculture.

C. Chemicals used in retreatment shall also be certified and state type of chemical and rate of concentration.

2.5 ACCESSORIES

A. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems
5. Green: Sewer systems.

2.6 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.7 FLOWABLE FILL

A. Stabilized flowable fly ash mixture with a maximum slump of 8" and a minimum unconfined compressive strength of 100 psi used to fill construction excavations.

B. Manufacturer: American Stone Mix or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify existing ground surfaces have been stripped of topsoil, root mat and existing pavement, unsatisfactory soils, concrete spoil, obstructions and deleterious material.

B. Following rough grading and prior to foundation excavation, placement of fill, or construction of the floor slabs, it is recommended that the exposed subgrade be proofrolled. The proofroll should be performed using a minimum 10-ton vibratory roller in the presence of the qualified soils technician working under the supervision of a geotechnical engineer. Yielding or otherwise unsuitable subgrade conditions encountered within the proposed building areas should be undercut to firm subgrade conditions and backfilled with compacted structural fill.

C. Locate underground utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations. Contact "Miss Utility".

D. Use of explosives will not be permitted, unless approved by Owner in writing and Regulatory Agencies having jurisdiction.

E. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

F. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

G. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

H. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 EXCAVATION

A. Excavation consists of removal and disposal of material encountered when establishing required finish grade elevations.

B. Unauthorized Excavations:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of A/E. Unauthorized excavation, as well as remedial work directed by A/E, shall be at Contractor's expense.
2. Under footings, foundations, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing to excavation bottom, without altering required top elevation. Lean concrete, flo-ash fill, or compacted structural fill may be used to bring elevations to proper position, when acceptable by A/E.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Soils Engineer who will make an inspection of conditions.

1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated materials as directed by A/E
2. Removal of unsuitable material below the subgrade elevation and its replacement as directed will be paid by the Owner on basis of contract conditions relative to change in work.

D. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of materials excavated.

1. Maintain sides and slopes of excavations in safe conditions until completion of backfilling.

E. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition.

1. Establish requirements for trench shoring and bracing to comply with local, State & Federal codes and authorities having jurisdiction.
2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

F. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Excavations shall be kept free of water for a minimum of two (2) inches below subgrade of excavation. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Convey water removed from excavations and rain water into approved sediment control devices. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.
3. Excessive groundwater conditions: Refer to Article 4.3.6 of the General Conditions.

G. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Prevent saturation of soil above the optimum moisture content.
2. Locate and retain soil materials away from edge of excavations.
3. Dispose of excess soil material and waste materials as herein specified.

H. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. If in excavating for building foundations the soil directly below the building foundations is disturbed, the disturbed soil shall be removed and shall be recompacted to 95% compaction or replaced with concrete backfill.

I. Excavation for Stone and Concrete Pavements: Cut surface under pavements to comply with cross sections, elevations and grades as shown:

1. Where rock or concrete spoil is encountered, carry excavation 18" below subgrade and backfill with suitable material approved by the A/E.

J. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed with ample working room.

1. Excavate trenches to depth, lines, gradients, and elevations indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze ups.
2. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.
3. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

   a. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.

4. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing. Concrete is specified in Division 3.
5. Do not backfill trenches until tests and inspections have been made and backfilling authorized by A/E. Use care in backfilling to avoid damage or displacement of pipe systems.

K. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F. (1 degree C.).

L. Ground Surface Preparation (Structural and Pavement areas):

1. The existing ground surface in the structural and pavement areas shall be stripped of topsoil, root mat, existing pavements, unsatisfactory soils, concrete spoil, obstructions and deleterious material. Base course material from the existing pavements may remain if approved by the A/E. The entire area shall be proof rolled, a minimum of four (4) passes, with a loaded dump truck with a minimum axle load of 10 tons in the presence of the soils engineer. Soft spots identified by the Soils Engineer during proofrolling will be undercut and backfilled in accordance with Section 3.4. Proofrolling and compaction equipment shall meet the requirements of Section 3.3.D. Undercutting and backfilling operations for eliminating soft spots above the subgrade elevation shall be included in the base bid.
2. In cut areas, prior to the construction of paving or concrete slab on grade, the entire subgrade shall be proofrolled in the presence of the Soils Engineer. Soft areas encountered during proofrolling shall be undercut and backfilled in accordance with section 3.4. Proofrolling and compaction equipment shall be in compliance with Section 3.3 D. The cost of undercutting and backfilling above the subgrade elevation shall be included in the base bid.

M. Earthwork Quantities:

1. Contractor shall be responsible for determining earthwork quantities for the completion of the work.

3.3 COMPACTION

A. General: Control soil compaction during construction providing percentage of dry density specified for each area classification.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of the maximum dry density which is determined in accordance with ASTM D 1557, or in accordance with ASTM D 2049 for soils which will not exhibit a well defined moisture density relationship.

1. Structural, pavement and walkway areas, steps and utility trenches - 95% of the maximum dry density.
2. Lawn areas outside the designated structural fill limits – minimum compaction 83% of the maximum dry density and maximum compaction of 88% of the maximum dry density.

C. Moisture Control: Obtaining a uniformly high degree of compaction requires control over the moisture content of the material being placed in the fills and backfill. The soils used in fill and backfill shall be brought to within 3% of optimum moisture at no additional cost to the Owner.

1. Where the soil layer is too dry, the Contractor shall apply water uniformly using approved equipment to increase the moisture content to within 3% of the optimum, taking precautions to prevent free water from appearing on the surface during or subsequent to compaction operations.
2. Where the soil layer is too wet, the Contractor shall dry the soils by plowing or discing to aerate the soil and reduce the moisture content to within 3% of the optimum.

D. Compaction equipment shall be as required to complete the scope of work outlined in the geotechnical report, contract documents and specifications for this project.

3.4 BACKFILL AND FILL

A. General: Place acceptable soil material in layers not more than eight (8) inches in thickness to required subgrade elevations, for each area classification listed below. Each layer shall be compacted to the requirements of Section 3.3B.

1. Fill and backfill within building and pavement limits and in utility trenches shall be structural fill soils meeting the requirements of Section 2.1.A.
2. Under lawn areas outside the designated structural fill limits, backfill and fill soils shall be soils meeting the requirements of Section 2.1.A, or other on site materials approved by the Geotechnical Engineer.
3. Fill and backfill located below walkways and steps shall be constructed of structural fill soils meeting the requirements of Section 2.1.A.
4. Drainage fill material shall be proof rolled to a uniform stable condition prior to placement of vapor retarder.
5. Stone base course shall be compacted to 95% maximum dry density per ASTM D-1557.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, subdrainage damp proofing, waterproofing, and perimeter insulation.
2. Concrete and masonry have cured 28 days and is adequately braced.
3. Inspection, testing, approval, and recording locations of underground utilities.
4. Removal of concrete formwork.
5. Removal of trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

C. Ground surface preparation: Shall be in accordance with Section 3.2K.

1. When existing ground surface has density less than that specified under Section 3.3B for particular area classification, break up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum dry density.

D. Placement and Compaction: Place backfill and fill materials in layers not more than 8" in loose depth, for material compacted by heavy compaction equipment and not more than 4" in loose depth for material compacted by hand operated tampers.

1. Before compaction, moisten or aerate each layer as may be necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density for each classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift.
3. Structural fill shall extend a minimum of five (5) feet beyond building and road pavement limits and shall include the support slopes to their full width.
4. Backfilling against pipe structures, whose joints involve the use of cement mortar or other concrete, or where buttresses are constructed, shall not be done until mortar has set at least 12 hours.
5. Compaction over one foot above the pipe shall be done with approved mechanical tampers. Compaction density shall be as specified in Section 3.3.

E. Utility trench backfill

1. Place and compact initial backfill of subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
2. Coordinate backfilling with utilities testing.
3. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
4. Fill voids with approved backfill materials while shoring, bracing, and sheeting is removed.
5. Place and compact final backfill of satisfactory soil material to final subgrade.
6. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.5 ROUGH GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surfaces with specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades. In fill areas, sloped surfaces steeper than 5 horizontal to 1 vertical shall be benched so that fill materials will be placed on a level surface. All fill subgrades shall be observed by the Geotechnical Engineer.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.
2. Walks: Shape surface or areas under walks to line, grade and cross section, with finish surface not more than .04' above or below required subgrade elevation.
3. Pavements: Shape surface areas under pavement to line, grade and cross section, with finish surface not more than .04' for bituminous surfaces and 08' for stone surfaces, above or below required subgrade elevation.

C. Grading Surface or Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of .02' when tested with a 10' straightedge.

3.6 BUILDING SLAB BASE COURSE

A. General: Slab base course consists of placement of drainage fill or stone base course material, in layers of indicated thickness, over subgrade surface to support concrete building slabs.

B. Placing: Place slab base course on prepared subgrade in layers of uniform thickness, conforming to indicate cross section and thickness. Maintain optimum moisture content for compacting material during placement operations.

1. When a compacted drainage course is shown to be 6" thick or less, place material in a single layer. Where shown to be more than 6" thick, place material in equal layers, except no single layers more than 6" or less than 3" in thickness when compacted.

C. Any ruts or soft yielding spots which may occur or any areas having inadequate compaction or deviations from the requirements set forth herein shall be corrected by removing and adding uniformly graded crushed stone or by loosening crushed gravel, reshaping and recompacting. The subgrade shall have a uniform density throughout its entire depth and width and shall be approved by the A/E prior to pouring any concrete.

D. Following this preparation, the subgrade shall be protected from damage as described below:

1. The subgrade shall be protected from damage by heavy loads or equipment moving on tracks or cleats.
2. The contractor shall at all times keep the subgrade drained.
3. No concrete shall be deposited upon a frozen subgrade nor, until the subgrade has been approved by the A/E.
4. Immediately in advance of placing concrete, the subgrade shall be sprinklered with as much water as it can readily absorb.

3.7 FINISH GRADING & PLACING TOPSOIL

A. Refer to Specification Section 329200 – “Turf and Grasses”

3.8 MAINTENANCE

A. Protection of graded areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re establish grades in settled, eroded and rutted areas to specified tolerances.

B. Reconditioning compacted areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

C. Restore areas previously occupied by stockpiled materials to match finished condition of the remainder of the work.

3.9 APPLICATION OF SOIL TREATMENT

A. Refer to Section 313116 Termite control

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials including trash, debris, and unsuitable and excess excavated material, and dispose of off Owner's property.

3.11 FIELD QUALITY CONTROL – SOILS

A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2922 and D-3017(shallow depth nuclear method), as applicable.
2. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab area, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case less than 2 tests. Field density tests shall be made at all walkway entrances and ramps into the proposed building.
3. Foundation Wall Backfill: Take enough field density tests to ensure backfill is being properly compacted.
4. Utility Trench Backfill: Perform field density tests on a spot-check basis to assist the Contractor in determining if compaction is in accordance with the specifications.
5. If in opinion of A/E, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.
6. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent evaluation and approval of each footing subgrade should be performed by Geotechnical Testing Agency.
7. Costs of testing and inspection shall be borne by the Contractor.

3.12 FIELD QUALITY CONTROL - SOIL TREATMENTS

A. Pay costs for required testing of termite control materials. Samples shall be taken and analyzed by an independent testing laboratory.

B. Sampling: Test one sample of working solution for each 10,000 square feet of area applied. Take samples from discharge end of spraying equipment for each batch mixed and applied if less than 10,000 square feet.

C. Retreating: Retreat all areas if the test results average less than 90 percent of listed minimum concentration.

3.13 TESTING AND INSPECTION

A. INSPECTION AGENCY: Construction Manager will employ an Independent Testing agency for purposes of inspecting and testing construction of embankments, fills, backfills, trenches, and subgrades and report to the A/E conformance in all particulars to specification requirements.

B. Scheduling:

1. Assign qualified personnel to be on site at all times when operations are scheduled.
2. The Contractor should note that no earthwork operation shall be permitted in their absence.

C. Responsibilities:

1. Evaluation of subgrade preparation and suitability.
2. Moisture content and field density tests on all layers of fill and backfill material placed.

3. Evaluation of degree of compaction attained for all fill and backfill material placed.
4. Testing and evaluation of borrow material.
5. Sources of borrow and of select fill.
6. Footing subgrade suitability.
7. Inspection of installation of Subdrainage system.

D. Results of Tests:

1. Make results available to the Soils Engineer and A/E immediately upon completion of areas of layers.

E. Final Report: The Inspection Agency shall prepare a written report that summarizes the work inspected during the course of the project. A discussion of all deviations from the contract documents and specifications, with their related impact on the final construction, shall be described in detail. The engineer of record shall review this final report, and recommend corrective measures (as deemed necessary) that must be made prior to final acceptance of the work. Prior to final payment, a written report certifying that the work meets the requirements of the contract documents, specifications, and all governing agencies shall be prepared, submitted, and approved by the A/E.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes construction dewatering.

B. Related Sections include the following:

1. Division 01 Section "Temporary Construction Utilities, Facilities and Controls" for temporary utilities and support facilities.
2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading and for site utilities.
3. Division 31 Section "Excavation Support and Protection."

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, well pointing or other means.
3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
4. Remove dewatering system if no longer needed.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Construction Manager and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
2. The geotechnical report is included elsewhere in the Project Manual.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks , maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids

inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 OBSERVATION WELLS

A. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated and additional observation wells as may be required by authorities having jurisdiction.

B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

1. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

END OF SECTION 312319

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Soil treatment with termiticide.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood preservative treatment by pressure process.
2. Division 07 Section "Sheet Metal Flashing and Trim" for custom-fabricated metal termite shields.

1.3 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than 10 years against infestation of subterranean termites.

1.4 SUBMITTALS

A. Product Data: For termiticide borate and metal mesh barrier system.

1. Include the EPA-Registered Label for termiticide and borate products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.
8. Areas of application.

E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located, and who employs workers trained and approved by bait-station system manufacturer to install manufacturer's products.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from a single manufacturer for each product.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" to schedule application of termiticide products.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

B. Apply borate treatment after framing, sheathing, and exterior weather protection is completed but before electrical and mechanical systems are installed.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, and terms for agreement period; and terms for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Termiticides:

a. Aventis Environmental Science USA LP; Termidor.
b. Bayer Corporation; Premise 75.
c. Dow AgroSciences LLC; Dursban TC Equity.
d. FMC Corporation, Agricultural Products Group; Talstar Prevail FT Torpedo.
e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

1. Service Frequency: Inspect monitoring stations no fewer than once every three months.

END OF SECTION 313116

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes temporary excavation support and protection systems.

B. Related Sections include the following:

1. Division 01 Section "Temporary Construction Utilities, Facilities and Controls" for temporary utilities and support facilities.
2. Division 31 Section "Earth Moving" for excavating and backfilling and for existing utilities.
3. Division 31 Section "Dewatering" for dewatering excavations.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Contractor is solely responsible for maintenance of excavations and worker safety. Architect, Owner and Construction Manager bear no liability for excavation support and protection systems.
2. Provide professional engineering services needed to assume engineering responsibility where required, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is included elsewhere in the Project Manual.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving overlay.
4. Asphalt surface treatments.
5. Pavement-marking paint.
6. Cold milling of existing hot-mix asphalt pavement.

B. Related Sections include the following:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.3 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. DOT: Delaware Department of Transportation.

1.4 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of Specifications for road and Bridge Construction of the Delaware Department of Transportation.

1. Standard Specification: Division 400
2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Job-Mix Designs: For each job mix proposed for the Work.

D. Qualification Data: For manufacturer.

E. Material Test Reports: For each paving material.

F. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

C. Regulatory Requirements: Comply with Delaware Department of Transportation Specifications for Road and Bridge Construction for asphalt paving work.

D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
2. Review condition of subgrade and preparatory work.
3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp. Adhere to all specifications in Delaware Department of Transportation Specifications for Road and Bridge Construction.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at minimum ambient or surface temperatures specified in the Delaware Department of Transportation Specifications for Road and Bridge Construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials: All materials used under this section shall conform to the requirements of Delaware Department of Transportation Specifications for Road and Bridge Construction, including, but not limited to: graded aggregate, asphalt cement, and tack coat.

B. Herbicide Treatment: Commercial chemical for weed control, registered by Environmental Protection Agency. Provide granular, liquid or wettable powder form. Obtain written approval from the Maryland Department of the Environment prior to application of the herbicide.

1. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. Ciba-Geigy Corp.
b. Dow Chemical, USA
c. E.I. Du Pont de Nemours & Co., Inc.
d. FMC Corp
e. Thompson-Hayward Chemical Co.
f. U.S. Borax and Chemical Corp.
g. Allied Chemical Corp.
h. Ag-Chem Products, Inc.

C. Lane Marking Paint: Paint shall comply with Division 700 of the Delaware Department of Transportation Specifications for Road and Bridge Construction.

1. Color: White
2. Color: Yellow
3. Color: Blue

D. Joint Sealants: Joint Sealants shall comply with Delaware Department of Transportation Specifications for Road and Bridge Construction, Divisions 700 & 800.

2.2 MIXES

A. Hot-Mix Asphalt: Provide Plant Mixed, hot-laid, asphalt-aggregate mixture complying with Delaware Department of Transportation Specifications for Road and Bridge Construction, Division 400 and referred Divisions.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with if formulated by manufacturer for that purpose.
2. Remove spillages and clean affected surfaces.

D. Proceed with paving only after unsatisfactory conditions have been corrected.

E. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into hot-mixed asphalt pavement. Distribute at a rate of 0.05 to 0.15 gal. Per sq. yd. of surface in accordance Section 401 of the Delaware Department of Transportation Specifications for Road and Bridge Construction.

F. Allow to dry until at proper condition to receive paving.

G. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

3.2 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of as specified on plans.
2. Mill to a uniform finished surface free of gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Transport milled hot-mix asphalt to asphalt recycling facility.
7. Keep milled pavement surface free of loose material and dust.

3.3 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 225 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Immediately correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course. Joints shall comply with Delaware Department of Transportation Specifications for Road and Bridge Construction, Section 401.12.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 98 percent of reference laboratory density according to AASHTO T 209, but not less than 96 percent nor greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Contractor shall provide striping on parking and roadway surfaces as indicated on the plans. The following is a list of all required striping:

1. Parking stalls.
2. Cross-hatch/gore areas.
3. Handicap Parking symbols.
4. Stop bars.
5. Directional arrows.
6. Lane lines.
7. Words/numbers.

C. Allow paving to age for 30 days before starting pavement marking.

D. Sweep and clean surface to eliminate loose material and dust.

E. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal. for all markings with the exception of parking stall lines.

3.10 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Construction Manager will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

   a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
   b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.
5. Unit paver base.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Samples: 10-lbsample of exposed aggregate.

D. Qualification Data: For manufacturer. Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

E. Material Test Reports: General contractor will engage a qualified testing agency for indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.

2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

G. Field quality-control test reports.

H. For plazas and wide walkways, submit control joint spacing plan for review.

I. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.

c. Ready-mix concrete producer.
d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

C. Epoxy-Coated Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel.

D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

H. Plain Steel Wire: ASTM A 82, as drawn.

I. Deformed-Steel Wire: ASTM A 496.

J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain.

K. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

L. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.

M. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

N. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

O. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

P. Zinc Repair Material: ASTM A 780.

2.4 CONCRETE MATERIALS

A. Materials: All materials including but not limited to reinforcing materials, concrete materials, concrete mix, admixtures, curing materials, traffic paint and other related materials used under this section shall conform to the requirements of the Delaware Department of Transportation Specifications for Road and Bridge Construction. References to a required class of concrete shall correspond to the classes as shown in the State of Delaware Department of Transportation Specifications for Road and Bridge Construction Division 500 and Division 800.

B. Fly ash shall meet the approval of the ASTM C-618 pozzolan Class F and may be used as a partial substitute for cement when approved by the Architect.

C. The concrete mix used in performing this work shall be DelDOT Class “A” or DelDOT Class “B” depending on the compressive strength shown on the details and shall meet the approval of the Architect.

D. The concrete temperature shall not exceed 90°F when delivered to the job-site or at any time prior to placement in the forms.

E. Type I - Portland Cement: Shall be used from October 1 through May 1 and when the air temperature in the shade and away from artificial heat is above 70°F or less, or as directed by the Architect.

A. Type II - Portland Cement: Shall be used from May 1 through October 1 and when the air temperature in the shade and away from artificial heat is above 70°F, or as directed by the Architect.

F. When approved by the Architect, Hi-Early strength concrete may be used. Approval will be on a case by case basis.

G. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: 1/2 to 3/4 inch nominal.
2. Aggregate Source, Shape, and Color: Submit color samples for review by Architect and owner

H. Water: ASTM C 94/C 94M.

I. Air-Entraining Admixture: ASTM C 260.

J. Chemical Admixtures: Admixtures may only be use with prior approval by the Architect. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 FIBER REINFORCEMENT

A. Synthetic Fiber: fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

1. Available Products:

a. Fibrillated Fibers:

1) Axim Concrete Technologies; Fibrasol F.
2) FORTA Corporation; Forta.
3) Euclid Chemical Company (The); Fiberstrand F.
4) Grace, W. R. & Co.--Conn.; Grace Fibers.
5) SI Concrete Systems; Fibermesh.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Available Products:

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edeco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.

g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, ChemRex Inc.; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation; Finishing Aid.
p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

E. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

1. Available Products:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
b. Burke by Edoco; Resin Emulsion White.
c. ChemMasters; Safe-Cure 2000.
d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
f. Euclid Chemical Company (The); Kurez VOX White Pigmented.
g. Kaufman Products, Inc.; Thinfilm 450.
h. Lambert Corporation; Aqua Kure-White.
i. L&M Construction Chemicals, Inc.; L&M Cure R-2.
j. Meadows, W. R., Inc.; 1200-White.
k. Symons Corporation; Resi-Chem White.
l. Tamms Industries, Inc.; Horncure 200-W.
m. Unitex; Hydro White.
n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Chemical Surface Retarder: (For exposed aggregate concrete) Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products:

a. Burke by Edeco; True Etch Surface Retarder.
b. ChemMasters; Exposee.
c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
d. Euclid Chemical Company (The); Surface Retarder S.
e. Kaufman Products, Inc.; Expose.
f. Metalcrete Industries; Surftard.

g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
h. Scofield, L. M. Company; Lithotex.
i. Sika Corporation, Inc.; Rugasol-S.
j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.

2.8 WHEEL STOPS

A. Wheel Stops: Solid, 3000 PSI concrete, precast.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.9 ADA TRUNCATED DOMES

A. General: In-line replacable designed to be installed in a “wet set” condition. Units must include anchors which allow replacement by removing colored covers and bolts while leaving anchors in place.

B. Materials: Homogenous glass and carbon reinforced composite

1. UV stable and colorfast.
2. Resistant to slat and chemical staining per ASTM B 117 & 1308.
3. Minimum Compressive and Tensile Strength of 28,900 psi and 11,600 psi respectively.
4. Must be able to handle load bearing capacity of 16,000 lbs per AASHO –H20 with no visible damage.
5. Color must be uniform throughout with no paint or coating to provide color.
6. Dome geometry must comply with ADA regulations for detectable warnings at curb ramps in diameter, height and spacing.

C. Where installation on radius is shown, provide precut and scored units for installation without gaps and piecemeal infills. Field cut rectangular units will not be acceptable.

D. Units shall be by ADA Solutions, Inc. or approved equal.

2.10 CONCRETE MIXTURES

A. The concrete mix used in performing this work shall be DelDOT Class “A” or DelDOT Class “B” depending on the compressive strength shown on the details and shall meet the approval of the Architect.

B. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

C. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi or 3000 psi. depending on location
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
3. Slump Limit: 2-5, plus or minus 1 inch.

D. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

F. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture, plasticizing and retarding admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

G. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals. Limits shall be as follows per DelDOT requirements:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

H. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116 where synthetic fibers are noted on the plans. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 20 feet, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. All Isolation Joints shall be treated with joint filler.
4. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. For larger walkways, width greater than 12' and plazas, submit shop drawing of joint pattern. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed pavement surfaces with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

K. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

L. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

M. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

N. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Construct test sections of each type of concrete paving, including at least one expansion joint and control joints, for review by CM, Owner and Architect for agreement of finish prior to starting concrete installation. Review will include texture of broom finish, joint striking, picture framing and geometric conformity.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3. Incorporate “picture framing” of concrete in finish within lump sum prices bid.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Construction Manager shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

B. Related Sections include the following:

1. Division 07 Section "Concrete Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
2. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F .
2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.3 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Products:

a. Crafco Inc.; RoadSaver Silicone.
b. Dow Corning Corporation; 888.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 321373

SECTION 321400

UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Precast concrete unit paver set in bituminous setting beds (on concrete base).
   2. Precast concrete unit paver set in aggregate setting beds (on concrete base).
   3. Aluminum edge restraints.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Precast concrete unit pavers.
   2. Bituminous setting materials
   3. Sand setting materials
   4. Joint sand.
   5. Joint materials including sealants
   6. Edge restraints.

B. Samples for Initial Selection: For the following:

   1. Manufacturers color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of unit paver indicated.
   2. Joint materials involving color selection.
   3. Exposed edge restraints involving color selection.

C. Samples for Verification:

   1. Full-size units of each type of unit paver indicated, showing the full range of colors, textures, and patterns selected.
   2. Joint materials.
   3. Exposed edge restraints.

D. Compatibility and Adhesion Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

E. Installer Qualifications:

1. An installer with at least ten years experience who has completed unit paver installations similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.
2. Submit installer qualifications per Division 01.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Before installing unit pavers and stone pavers build mockups for each form and pattern of unit pavers required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, special features for expansion joints, and contiguous work as indicated.

1. Build 8’ x 8’ mockups for the following Add Alternate pavers, in the location as directed by the Architect.
   a. Plaza pavers adjacent to building, utilizing the full range of paver colors.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting unit paver installation.
4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
5. Demolish and remove mockups when directed.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site after construction of mockups and prior to final installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquids in tightly closed containers protected from freezing.

E. Store asphalt cement and other bituminous materials in tightly closed containers.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Bituminous Setting Bed:

1. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry.
2. Apply asphalt adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

PART 2 - PRODUCTS

2.1 CONCRETE UNIT PAVERS (BASE BID)

A. Manufacturer: Hanover Architectural Products, Hanover, PA 800.426.4242

B. ADA Curb Ramp pavers
1. Product name: Prest Paver Detectable Warning Paver
2. Color: Charcoal
3. Finish: Tudor
4. Thickness: 2 1/2” plus truncated dome height
5. Face size: 12” x 12”

C. Fire Lane Boundary Striping
1. Product name: Prest Brick
2. Color: Safety Yellow.
3. Finish: Natural.
4. Thickness: 3”
5. Face Size: 4” x 8”

2.2 CONCRETE UNIT PAVERS (ADD ALTERNATE)

A. Manufacturer: Hanover Architectural Products, Hanover, PA 800.426.4242

B. Plaza Pavers
1. Product name: Prest Brick Plankstone Paver
2. Color: #M3257
3. Finish: Tudor
4. Thickness: 4”
5. Face Size: 2-7/8” x 8-13/16”
6. Face Size: 2-7/8” x 17-5/8”

C. Plaza Pavers
1. Product name: Prest Brick Plankstone Paver

2. Color: #M1983
3. Finish: Tudor
4. Thickness: 4”
5. Face Size: 2-7/8” x 8-13/16”
6. Face Size: 2-7/8” x 17-5/8”

D. Plaza Pavers
1. Product name: Prest Brick Plankstone Paver
2. Color: #M2298
3. Finish: Tudor
4. Thickness: 4”
5. Face Size: 2-7/8” x 8-13/16”
6. Face Size: 2-7/8” x 17-5/8”

2.3 ACCESSORIES

A. Aluminum Edge Restraints:
1. Manufacturer: Permaloc Corporation.
2. Product name: Structure Edge
3. Size: 1/8” x 2-1/4”
4. Color: Mill Finish

B. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

2.4 BITUMINOUS SETTING-BED MATERIALS (ADD ALTERNATE)

A. Primer for Base: ASTM D 2028, cutback asphalt, grade as recommended by unit paver manufacturer.

B. Fine Aggregate for Setting Bed: ASTM D 1073, No. 2 or No. 3.

C. Asphalt Cement: ASTM D 3381, Viscosity Grade AC-10 or Grade AC-20.

D. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos.

2.5 BITUMINOUS SETTING-BED MIX (ADD ALTERNATE)

A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate, unless otherwise indicated. Heat mixture to 300 deg F.

2.6 SAND FOR JOINTS

A. Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve. ASTM C33 Concrete sand.

1. Provide sand of color needed to produce required joint color.

2.7 SAND FOR LEVELING COURSE (BASE BID)

A. Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair asphalt bond, including curing and sealing compounds, form oil, and laitance.

B. Clean concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Exercise care in handling coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. Remove coating from bonding surfaces before setting brick.

E. Joint Pattern: Running Bond

F. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

G. Expansion and Control Joints: Provide joint filler at locations and of widths indicated. Install joint filler before setting pavers.

H. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

1. Install edge restraints to comply with manufacturer's written instructions. Install masonry nails at intervals required to hold edge restraints in place during and after unit paver installation.

3.4 BITUMINOUS SETTING-BED APPLICATIONS

A. Apply primer to concrete slab immediately before placing setting bed.

B. Prepare for setting-bed placement by locating 3/4-inch deep control bars approximately 11 feet apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated.

C. Place bituminous setting bed where indicated, in panels, by spreading bituminous material between control bars. Spread mix at a minimum temperature of 250 deg FStrike setting bed smooth, firm, even, and not less than 3/4 inch thick. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill depressions that remain after removing depth-control bars.

1. Roll setting bed with power roller to a nominal depth of 3/4 inch. Adjust thickness as necessary to allow accurate setting of unit pavers to finished grades indicated. Complete rolling before mix temperature cools to 185 deg F

D. Apply neoprene-modified asphalt adhesive to cold setting bed by squeegeing or troweling to a uniform thickness of 1/16 inch. Proceed with setting of paving units only after adhesive is tacky and surface is dry to touch.

E. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.

F. Joint Treatment: Place unit pavers with hand-tight joints. Fill joints by sweeping sand over paved surface until joints are filled. Remove excess sand after joints are filled. Repeat joint filling process after 30 days.

3.5 SAND SETTING BED APPLICATIONS (ADA Detectable Warning Pavers and Fire Lane Striping Pavers only)

A. Place sand leveling course and screed to a thickness of 1 to 1-1/2 inches taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.

B. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer

bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers.

C. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

D. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

E. Do not allow traffic on installed pavers until sand has been vibrated into joints.

F. Repeat joint-filling process 30 days later.

3.6 REPAIRING AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 321400

SECTION 321817 – SYNTHETIC TRACK SURFACING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. All weather resilient synthetic track surface over asphalt base, with striping.

1.3 SCOPE

A. The synthetic surfacing contractor shall furnish all labor, materials, equipment, supervision and services necessary for the proper completion of the synthetic track surfacing system and related work indicated on the drawings and specified herein.

B. The synthetic surfacing contractor shall refer to the drawings for the required locations of synthetic track surfacing to be installed. All quantities and dimensions shall be field verified by the synthetic surfacing contractor.

1.4 SPECIFIC SCOPE OF WORK

A. Install an IAAF approved, impermeable polyurethane synthetic track system consisting of SBR Rubber and a single component polyurethane binder and a poured in place, two component U.V. stabilized elastomeric polyurethane wearing layer with an embedded textured finish.

B. Layout and paint all lines and event markings as required and specified by current NFSHSA, IAAF, and NCAA rules.

1.5 COORDINATION

The synthetic surfacing contractor shall coordinate the work specified with an authorized and appointed representative of the owner so as to perform the work during a period and in a manner acceptable to the owner.

1.6 APPLICABLE PUBLICATIONS

Codes and standards follow the current guidelines set forth by the International Amateur Athletic Federation (IAAF) and the National Collegiate Athletic Association (NCAA), along with the current material testing guidelines as published by the American Society of Testing and Materials (ASTM).

1.7 SUBMITTALS

A. Product Data: For material indicated.

B. Samples for Verification: For each type and color of material required.

C. Product Certificates: Signed by manufacturers of track surface certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Test results from an IAAF Testing Laboratory confirming compliance to the performance of athletic tracks test according to the IAAF.

1.8 PERFORMANCE STANDARDS

A. The synthetic track surfacing system shall exhibit the following minimum performance standards as required by IAAF:

1.	Thickness	≥ 13mm
2.	Force Reduction	35 to 50%
3.	Modified Vertical Deformation	0.6 to 1.8mm
4.	Friction	≥ 47 TRRL Skid Resistance
5.	Tensile Strength	≥ 0.5 MPa
6.	Elongation at Break	≥ 40%

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An experienced factory trained installer who has specialized in installing similar in material, design, and extent to those indicated for this Project and whose work has resulted with a record of successful in-service performance.

B. The uniformity of both grade and planarity is intended to meet governing body specifications. Slopes shall meet those set forth in the rules for track and field for the intended use of the facility (NFSHSA). Complete rules and regulations are available from the National Federation of State High School Associations (NFSHSA) at 816-464-5400. Slopes shall not be less than .75%. Finished slopes shall match those shown on the grading plans.

C. The finished surface of the leveling course shall not vary more than 3/16” in any direction when measured with a 10’ straight-edge. Elevations shall be taken every twenty-five feet in the running direction at the inside edge, centerline and outside edge of track. Elevations on the high jump shall be taken on a 10’ grid. Any area that does not have the correct cross slope shall be documented and reported to the owner prior to construction start up and staging of materials.

D. Track surfacing contractor shall check the asphalt for compliance, and reject, for correction, any base which is not within specifications.

E. Certification – Upon the completion of the stone and asphalt base, the construction shall be checked by a licensed professional engineer or land surveyor for compliance with the lines and grades set forth in the plans and specifications. Upon completion of the survey, the licensed professional engineer or land surveyor shall certify that the track and field events are constructed in accordance with the plans and

specifications.

F. Line striping and event markings shall be laid out in accordance with current IAAF and NCAA rules. Upon Completion of the installation, the owner shall be supplied with all necessary computations and drawings as well as a letter of certification attesting to the accuracy of the markings.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.11 PROJECT CONDITIONS

A. Asphalt Substrate: The asphalt upon which the TRACK SURFACE is installed shall be clean, free-draining, and shall exhibit the planarity and tolerances set forth in Court and Field Diagram Guide as published by the National Federation of State High School Associations (NFSHSA).

B. Weather Conditions: The quality of the installation is dependent upon proper weather conditions. No installation shall be made when rain is imminent or when ambient temperatures are below 50 degrees F. It is best to install the system in sunny weather with day-time temperatures of at least 60 degrees F. When night-time temperatures fall below 45 degrees F, the system should not be installed.

C. Installation shall not take place if adjacent or concurrent construction generates excessive dust, abrasives or any other by-product that, in the opinion of the installer, would be harmful to the

track material, until completion of such works.

1.12 WARRANTY

A. All synthetic track surfaces shall be fully warranted against defects in workmanship and materials. The specific length of the warranty shall be five (5) years. The contractor shall repair or replace defective surface at no cost to the owner. Excluded from the warranty are defects caused by faulty design, acts of God, improper maintenance, abuse, and uses other than those set forth above. The owner is required to maintain the facility in accordance with the maintenance instructions which are provided with the warranty.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Elastomeric Polyurethane

1. Two component U.V. stabilized elastomeric polyurethane compounded from polyol and isocyanate components, based on one hundred percent (100%) Methylene Diphenyl Isocyanate (MDI). No Toluene Diisocyanate Isocyanate (TDI) will be allowed.
2. The elastomeric polyurethane color shall be verified with owner/architect.

B. EPDM Granulate

1. The EPDM granulates shall be 1 to 3mm in size and peroxide cured.
2. The EPDM granulates and the U.V. stabilized elastomeric polyurethane shall be color matched.

C. Rubber Granulate of the Base Course

1. Styrene Butadiene Rubber (SBR) processed ground to a graded size of 1 to 3mm.
2. A maximum of 82%, by weight of the paved-in-place base layer, of SBR will be allowed.

D. Single Component Polyurethane Binder

Shall be a single-component polyurethane binder with a long cure time for use in paved mat specifications. A minimum of 18%, by weight of the paved-in-place base layer.

E. Seal Coat

Shall be a two-component polyurethane pore sealer used with paved rubber granule mats. The granular SBR and binder layer shall be sealed with the two-component polyurethane pore sealer. The application of EPDM dust is not allowed.

F. Line Marking Paint

Single-component, moisture cured, aliphatic polyurethane paint.

2.2 REPRESENTATIVE PRODUCT

A. BSS 300 Embedded Synthetic Track Surfacing System as manufactured by:

Beynon Sports Surfaces, Inc.
16 Alt Road
Hunt Valley, MD 21030
Phone: 410-771-9473
Fax: 410-771-9479
E-Mail: dbeynon@beynonsports.com

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine existing track surface for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting track surface performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Sub-base

1. The Synthetic Track Surfacing System shall be laid on an approved sub-base. The General Contractor shall provide compaction test results of 95% or greater for the installed sub-base and asphalt surface.

2. For NCAA certification the following criteria must be followed. The track surface, i.e. asphalt substrate, shall not vary from planned cross slope by more than + .2%, with a maximum lateral slope outside to inside of 1%, and a maximum slope of 0.1% in any running direction. The finished asphalt shall not vary under a 10' straight edge more than 1/8”.

3. It should be the responsibility of the asphalt-paving contractor to flood the surface immediately after the asphalt is capable of handling traffic, but within 24 hours. If, after 20 minutes of drying time, there are birdbaths evident, it shall be the responsibility of the architect, in conjunction with the surfacing contractor to determine the method of correction. No cold tar patching, skin patching or sand mix patching will be acceptable.

4. Any oil spills (hydraulic, diesel, motor oil, etc.) must be completely removed, either by chipping out or removing and replacing with new, keyed in asphalt. The minimum depth of any asphalt replacement shall be one inch. The curing time for the asphalt base is 28 days. It shall be the responsibility of the surfacing contractor to determine if the asphalt substrate has cured sufficiently prior to the application of polyurethane surfacing system.

5. It shall be the responsibility of the track surface contractor to determine if the asphalt substrate meets all design specifications, i.e. cross slopes, planarity and specific project criteria. After all the above conditions are met, the synthetic surfacing contractor must, in writing, accept the planarity of the asphalt receiving base, before work can commence.

B. Thickness

The thickness of the Synthetic Track Surfacing System shall be 13mm.

C. Equipment

The Synthetic Track Surfacing System components shall be processed and installed by specially designed machinery and equipment. A mechanically operated paver with variable regulated speed and thermostatically controlled screed shall be used in the installation of the base mat. The wearing course shall be installed using automatic electronic portioning, which provides continuous mixing and feeding for an accurate, quality controlled installation.

D. Installation

1. Base Course - The SBR granules and single compound polyurethane binder shall be mixed together on site to regulate the ratio/quantity of SBR, not to exceed 82% in the base mat portion of the system. The single compound polyurethane binder shall be mixed with the SBR rubber so that a minimum of 20%, by weight, exists in the final mixture. This mixture is then mechanically installed using the paver.

2. Seal Coat - The two component polyurethane pore sealer shall be mixed at the prescribed ratio homogeneously with a suitable mixing device. The coating is squeegee applied to the base mat, making it impermeable. EPMD dusting in not allowed.

3. Wearing Course - The 1 to 3mm EPDM granules shall be integrated into the two-component U.V. stabilized elastomeric polyurethane to achieve the full depth of the 5 mm wearing course. The

resilient embedded textured finish shall be a dense matrix of exposed EPDM granules. The homogeneous wearing course shall be applied in situ with the base course.

3.3 POST-INSTALLATION INSPECTION

A. Mat Construction: The track and field event surface shall be constructed in accordance with methods approved by the manufacturer of the system.

B. The finished surface shall be uniform in appearance, depth and density.

C. Provide track markings in accordance with NFSHSA, IAAF, and NCAA rules and regulations.

3.4 CERTIFICATION

Upon completion of the installation, the owner shall be supplied with all necessary computations and drawings as well as a letter of certification attesting to the accuracy of the markings.

3.5 CLEANING

Clean off excess material as the Work progresses by methods and with cleaning materials approved by product manufacturers.

3.5 PROTECTION

Protect track surface during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so track surfaces are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated track surface immediately so installations with repaired areas are indistinguishable from the original work.

3.5 GUARANTEE

The Synthetic Track Surfacing System shall be fully guaranteed against faulty workmanship and material failure for a period of five (5) years from the date of acceptance.

Synthetic surfacing material found to be defective as a result of faulty workmanship and/or material failure shall be replaced or repaired at no charge, upon written notification within the guarantee period.

END OF SECTION 321817

SECTION 321818 – TENNIS COURT PAVEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. All weather resilient acrylic-bound tennis courts over asphalt base, with striping.

B. Related Sections include the following:
   1. Division 321216 "Asphalt Paving" for constructing asphalt concrete paving base platform for tennis court upon which surface mix is to be placed.
   2. Section 321817 “Exterior Athletic Equipment” for Tennis Nets
   3. Section 323119 “Chain Link Fences & Gates” for surrounding fencing.

1.3 SUBMITTALS

A. Product Data: For material indicated, along with test data from an independent testing lab. Test results for weatherometer test, flexibility test and water resistance test.

B. Samples for Verification: For each type and color of material required.

C. Product Certificates: Signed by manufacturers of tennis surface certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced factory trained installer who has specialized in installing similar tennis court installations in material, design, and extent to those indicated for this Project and whose work has resulted in a record of successful in-service performance.

B. Acceptance Test: Prior to application of a color finish system, the court surface shall be flooded with water and allowed to drain for one hour at 70 degrees. There shall be no ponding or bird bath areas on the tennis courts deeper than a U.S. nickel laid flat. Any ponding or bird bath areas not meeting this requirement shall be patched and leveled by the Contractor. Reflood and patch until “birdbaths” are eliminated.

C. Quality Assurance: Comply with Delaware Department of Transportation Standard Specifications, latest edition.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Do not apply prime and tack coats when temperature is below 50 deg F (10 deg C) or when base is wet. Apply hot-mixed asphalt paving only when temperature is above 40 deg F (4 deg C) and when base is dry

B. Drainage: The areas adjacent to the tennis courts shall be graded to drain surface water away from the stone and asphalt base. Subsurface drainage shall provide for a free flow of subsurface moisture away from the stone base.

C. WARRANTY

D. The TENNIS COURTS shall be warranted against defects in workmanship and materials and structural cracking. The specific length of the warranty shall be five (5) years. The contractor shall repair or replace defective surface at no cost to the owner. Excluded from the warranty are defects caused by faulty design, acts of God, improper maintenance, abuse, and uses other than those set forth above. The owner is required to maintain the facility in accordance with the maintenance instructions which are provided with the warranty. Warranty shall be in the form of a Performance Bond.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Tennis Court Surfacing Materials shall be:

Novacrylic® , as manufactured by Nova Sports U.S.A., 6 Industrial Rd., Bldg. #2., Milford, MA 01757. 800-USA-NOVA or approved equal. All coatings shall be pure acrylic, containing no asphaltic or tar emulsions, nor any vinyl, alkyd or non-acrylic resins. The color system shall be factory-mixed compounds requiring only the addition of water at the jobsite except for the addition of sand to Novasurface® . All materials shall be delivered to the jobsite in sealed containers with the manufacturer’s label affixed.

A. Line paint shall be factory-compound product compatible with asphalt. White line paint shall be American Tennis Courts or approved equal Latexite Acrylic Line Paint. Use undiluted for painting of playing lines.

B. Tennis nets and posts shall be furnished by other trades and installed by the contractor.

C. Ground sleeves shall be Schedule 40 P.V.C. for tennis net posts. Note: Provide sleeves with a special cannon plug "air tight" seal, to prevent anchor slippage from concrete footing when tennis net s are set too tight. Length and method as recommended by tennis post manufacturer.

D. Center tie-down anchors shall be American Tennis Courts or approved equal "Sure Grip" metal center tie-down anchors. Anchors shall contain an industrial grade steel collar, welded in place to prevent anchor slippage from concrete footing when tennis nets are set too tight.

E. Surface Course: Type D, meeting the requirements of DOT Specifications, Section 401.

F. Leveling Course: Type C, meeting the requirements of DOT Specifications, Section 401.

G. Graded Aggregate Base Course: DOT Specifications Section 302 and Section 821, (Type B crusher run).

H. Concrete: "Class B" (3,000 psi) meeting the requirements of DOT Specifications, Section 602.

I. Stonedust: DOT Specifications, Section 307 and Section 813, (gradation requirements Del No. 10).

J. Herbicide Treatment: Commercial chemical for weed control, registered by Environmental Protection Agency and approved by the State of Maryland. Provide granular, liquid, or wettable powder form.

K. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
   a. Allied Chemical Corp.
   b. Achem Products, Inc.
   c. Ciba-Geigy Corp.
   d. Dow Chemical U.S.A.
   e. E.I. Dupont De Nemours & Co., Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine base course with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting tennis court surface performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONSTRUCTION PREPARATION

A. Proof roll the subgrade and do all necessary rolling and compaction to obtain a firm, even subgrade surface conforming to the lines and grades set forth on the plans and consolidate depressed areas. Remove all unsuitable materials, replace with clean fill, and compact to 100% of the maximum dry density in accordance with ASTM D-1557 Modified Proctor Method.

3.3 INSTALLATION: STONE BASE

A. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry subbase prior to application of prime coat.

B. Filter Fabric: Install filter fabric over area to receive base.

C. Spreading: The stone base material shall be spread by methods, and in a manner proposed by the contractor to produce a uniform density and thickness and the grades and dimensions shown on the drawings.

D. Compaction: The stone base shall be compacted by rolling with a powered steel wheel tandem roller weighing not less than eight tons. The compacted surface of the stone base shall not vary more than ½" from the required elevations.

E. Furnish and install stone dust to fill all cracks and construct minimum one inch (1") compacted thickness layer over the stone base surface. The stone dust shall be dampened and placed into all surface cracks and compacted with a vibrator plate compactor so that the compacted stone is level with the adjacent tennis court surface. The Contractor shall continue to place and dampen the stone dust to achieve maximum compaction with a three to five ton (3-5 ton) roller(s) placing thin layers of stone dust, until there is a minimum of one inch (1") thick compacted layer of stone dust. The average inplace density shall be at least 95% of the lab density when tested in accordance with the appropriate AASHTO requirements. The finished surface of the stone dust base course shall not vary more than one-quarter inch (1/4") in ten feet (10') when measure in any direction. Coordinate installation of ground sleeves.

3.4 INSTALLATION: LEVELING COURSE

A. Paving joints in the Leveling Course and Surface Course shall be constructed so as to prohibit joints being placed directly upon one another. The contractor may criss-cross paving operations of the Leveling and Surface Courses (but the surface asphalt course must be layed perpendicular to the net line) on the Stone Dust Sub-Base, or by varying the width of the paving passes, if courts are to be paved in the same directions. Compaction shall be performed in accordance with the requirements contained elsewhere in the Contract Documents.

B. Construct a Bituminous Stablized Leveling Course Mix Type C, two and one half inches (2-1/2") Compacted Thickness, over the Stone Dust Sub-Base followed by the construction of a Bituminous Concrete Surface course Mix Type D.

C. Spreading: The asphalt mixture shall be spread using a mechanical asphalt spreader, the condition of which shall be suitable for achieving the tolerances specified hereinafter. The minimum compacted thickness shall be 2" as indicated on the drawings.

D. Compaction: The asphalt mixture shall be thoroughly compacted with a steel wheel tandem roller weighing not less than four tons. The finished surface of the leveling course shall not vary more than ¼" from the required elevations.

3.5 INSTALLATION: SURFACE COURSE

A. Following the construction of the Bitumious Concrete Surface Course Mix Type D, check the entire newly constructed surface for depressions over one-eighth inch (1/8"). The Contractor shall check the finished surface with a ten foot (10') straight edge; projections and/or depressions of more than one-eighth inch (1/8") in ten feet (10') shall be corrected before proceeding. The contractor shall asphalt patch any and all depressions one-half inch (1/2") and over.

B. Spreading: The asphalt mixture shall be spread using a mechanical asphalt spreader, the condition of which shall be suitable for achieving the tolerances specified hereinafter. The minimum compacted thickness shall be 1.5" as indicated on the drawings.

C. Compaction: The asphalt mixture shall be thoroughly compacted with a steel wheel tandem roller weighing not less than four tons. The finished surface of the surface source shall not vary more than 1/8"

from the required elevations, nor shall it vary more than 1/8” in any direction when measured with a ten-foot straightedge.

D. Allow fourteen (14) days curing time for the Asphalt Surface Course before proceeding with the scraping and cleaning of loose material(s) from the entire surface area.

3.6 POST-INSTALLATION INSPECTION

A. Inspection of Competed Asphalt Paving: Upon completion, the asphalt pavement shall be inspected by a licensed professional engineer or land surveyor. The inspection shall verify that the dimensions, slopes and elevations of the asphalt paving meet the tolerances set forth herein. Areas of the asphalt paving which do not meet the tolerances shall be corrected by the paving contractor. High spots shall be milled to the proper elevations, or may be cut out and replaced. Low areas shall be corrected by removing the 1.5” surface course of asphalt and replacing with hot surface course plant mix.

3.7 ACRYLIC FINISH INSTALLATION

A. New asphalt pavement shall cure for 14 days prior to application of any surfacing materials.

B. Contractors must notify the Landscape Architect of all applications, 48 hours prior to installation. The surface to be coated shall be inspected and made sure to be free of grease, oil, dust, dirt and other foreign matter before starting work.

C. The surface shall be flooded. Any ponding water remaining that is deep enough to cover the thickness of a five-cent piece shall be corrected using a patch mix consisting of Novabond® , 50-mesh sand and Portland cement, as per manufacturers directions. Depressions must be primed with a 50% dilution of Novabond® and water prior to patching.

D. Application shall proceed only if the surface is dry and clean and the temperature is at least fifty degrees (50°F) and rising, and the surface temperature is not in excess of one hundred forty degrees (140°F). Do not apply coatings when rain is imminent.

E. Each coat in this system must dry completely before next application. Between each coat, inspect entire surface. Any defects should be repaired. Scrape surface to remove any lumps, and broom or blow off all loose matter.

F. Using a neoprene rubber squeegee, apply one (1) coat of Novasurface® acrylic resurfacer, diluted with one (1) part clean water to two (2) parts Novasurface® . Clean, bagged sand shall be incorporated into the diluted Novasurface® at the rate of five (5) to ten (10) Lbs. per gallon. Sand gradation shall be 50 to 60-mesh. Allow application to dry thoroughly.

G. Using a neoprene rubber squeegee, apply two (2) coats of Novafil® , diluted two (2) parts concentrated material to one (1) part clean water (colors to be designated by owner). Allow each application to dry thoroughly. The quantity of water used in diluting these coatings may exceed the quantity specified by only a small amount and only if coatings are drying too rapidly. Permission of the owner shall be obtained before adding additional water.

H. Using a neoprene rubber squeegee, apply one (1) coat of Novacoat® , diluted one (1) part concentrated material to one (1) part clean water (colors to be designated by owner). Allow application to dry thoroughly. The quantity of water used in diluting these coatings may exceed the quantity specified by only a small amount and only if coatings are drying too rapidly. Permission of the owner shall be obtained before adding additional water.

3.8 ACRYLIC FINISH INSTALLATION LINE MARKINGS

A. Upon completion and acceptance of the tennis surface, this Contractor shall prepare and paint lines for tennis.

B. All lines are to be applied by painting between masking tape with a paintbrush or roller, according to U.S.T.A specifications.

C. Prime masked lines with Seal-A-Line® . Allow application to dry.

D. Paint lines with Novatex® textured line paint. Allow application to dry.

E. Remove masking tape immediately after lines are dry.

F. Protect adjacent areas and structures (fences, posts, sidewalks, buildings, etc.), which are not to be coated. In the event that coatings are applied to above, remove immediately before drying is complete.

3.9 COMPLETION

A. Upon completion, the contractor shall insure proper removal of all construction debris, surplus materials, empty containers and wash water, and shall leave the site in a condition acceptable to the owner. The court is to be left secure so as to prevent vandalism.

3.10 CLEANING

A. A.Clean off excess material as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur. Upon completion remove all containers, debris, etc. and leave the site in acceptable condition.3.9

3.11 PROTECTION

A. Protect tennis court surface during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so track surfaces are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated tennis court surface immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 321818

SECTION 323113

CHAIN-LINK FENCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes chain-link fences and swing gates.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   1. Provide fencing system including top and bottom rails, single and double swing gates with appropriate cross bracing and post size, post caps, closing and locking hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each polymer-coated product and for each color and texture specified, in 12 inch lengths for components and on full-sized units for accessories.

D. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence and gate, from manufacturer.

B. Product Test Reports: For framing strength according to ASTM F 1043.

C. Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Five years from date of Substantial Completion.

1.7 FIELD CONDITIONS: Coordinate fencing work with location and installation of other work including planting.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: 6’-0” (site perimeter) and 3’-6” (track perimeter)
2. Steel Wire Fabric: Wire with a diameter of 0.192 inch

a. Mesh Size: 2 inches.
b. Polymer-Coated Fabric: ASTM F 668, over coated steel wire.

1) Color: Black, complying with ASTM F 934.

3. Selvage: Knuckled at both selvages. Install fabric with minimum selvage extending above and below rails.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: 6’-0”
2. Light Industrial Strength.

a. Line Post: 2.375 inches in diameter, or as approved
b. End, Corner and Pull Post: 2.875 inches

B. Horizontal Framework Members:
1. Top and bottom rails complying with ASTM F 1043.
2. Brace Rails: Comply with ASTM F 1043.
3. Metallic Coating for Steel Framing:

a. Type A zinc coating.
b. Type B zinc with organic overcoat.
c. External, Type B zinc with organic overcoat and internal, Type D zinc-pigmented coating.
d. Type C, Zn-5-Al-MM alloy coating.
e. Coatings: Any coating above.

4. Polymer coating over metallic coating.

a. Color: Black, complying with ASTM F 934.

2.3 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types.

1. Gate Leaf Width: As indicated.
2. Gate Fabric Height: To match fence height.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded or assembled with corner fittings.

D. Hardware:

1. Hinges: 360-degree inward and outward swing as allowed by site conditions
2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate on 14 foot access gate to maintenance area
3. Drop Bars to hold gate leaves open: one per leaf.
4. Closer: Manufacturer's standard.

2.4 CONCRETE MIXTURES FOR FOOTINGS

A. Comply with ACI 301 requirements for concrete mixtures.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of slabs to receive troweled finishes to exceed 3 percent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, concrete work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading and installation of concrete perimeter curb is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 100 feet or line of sight between stakes. Indicate locations of utilities, underground structures, benchmarks, and property monuments.

D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

E. Post Excavation: Drill or hand-excavate holes for posts to diameters indicated on drawings, in firm, undisturbed soil. Spacing between posts not to exceed 10’-0” maximum.

F. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect above ground portion of posts from concrete splatter.
   a. Concealed Concrete: Top 3 inches below grade as indicated on drawings to allow covering with surface material.
   b. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
   c. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

G. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.

H. Line Posts: Space line posts uniformly at 96 inches o.c. or to be spaced equally along overall dimension.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework.

1. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated.
2. Minimize dimension of selvage above and below rails.
3. Do not install fabric on an angle for sloped fencing. Cut fabric to maintain alignment of non-sloped fencing.

J. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

K. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION 323113

SECTION 323119

DECORATIVE FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative metallic-coated-steel tubular picket fences and gates
2. Decorative aluminum fences and gates
3. Vinyl Board on Board fences and gates.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design decorative fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   1. Provide fencing system including top and bottom rails, single and double swing gates with appropriate cross bracing and post size, post caps, closing and locking hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fence panels and gates. Include plans, elevations, sections, details, hardware and attachments to other work.

C. Samples: For each fence material and for each color specified.

1.4 DELIVERY, STORAGE AND HANDLING

A. Provide manufacturer's standard limited warranty that its ornamental fence system is free from defects in material and workmanship including cracking, peeling, blistering and corroding for a period of 15 years from the date of purchase.

PART 2 - PRODUCTS

2.1 DECORATIVE METALLIC-COATED-STEEL TUBULAR PICKET FENCES

A. For all football stadium perimeter fences and gates

B. Decorative Metallic-Coated-Steel Tubular Picket Fences: Comply with ASTM F 2408, for light industrial (commercial) application (class) unless otherwise indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Fence Products ; Montage Commercial; Majestic 3 rail or comparable product by one of the following:
      a. BetaFence USA LLC.
      b. Master Halco.

C. Post Caps: Formed from steel sheet and hot-dip galvanized after forming .

D. Pickets: Square tubes.

   1. Terminate tops of pickets at top rail for flush top appearance .
   2. Picket Spacing: 4 inches clear, maximum.
   3. Picket size: ¾" square x 14 ga

E. Post : Square tubes
   1. Line post size: 2 1/2:" square x 14 ga
   2. Gate post size: 3" x 12 ga

F. Rails : two top rails and one bottom rail
   1. Rail size: 1 ½" x 1 7/16" channel

G. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc, alloy-coated steel sheet.

H. Finish: Organic coating complying with requirements in ASTM F 2408 .

2.2 DECORATIVE ALUMINUM FENCES

A. For all site perimeter fences and gates – to match existing fencing behind residences along Route 8.

B. Decorative Aluminum Fences: Fences made from aluminum extrusions.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Fence Products; Echelon Plus Majestic ¾ Rail or comparable product by one of the following:
      a. Jerith Manufacturing Company, Inc.
      b. Master Halco.

C. Posts: Square extruded tubes, 2-1/2 by 2-1/2 inches minimum; post size varies per height per manufacturers with 0.093-inch wall thickness.

D. Post Caps: Aluminum castings.

E. Rails: Extruded-aluminum channels, 1-1/2 by 1-7/8" inches, with 0.100-inch- thick sidewalls and 0.070-inch- thick top .

F. Pickets: Extruded-aluminum tubes, 3/4 inch square, with 0.050-inch wall thickness , terminated as indicated.

1. Picket Spacing: 4 inches clear, maximum.

G. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components.

H. Fabrication: Assemble fences into sections by fastening pickets to rails.

I. Finish: Baked enamel or powder coating.
1. Color: Black

2.3 SWING GATES

A. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes with wall thickness.

B. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

C. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

D. Aluminum Finish: Baked enamel or powder coating.

2.4 MISCELLANEOUS MATERIALS

A. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.

2.5 GROUNDING MATERIALS

A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Aluminum.
2. Material on or below Finished Grade: Copper.

B. Grounding Connectors and Grounding Rods: Comply with UL 467.

2.6 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: Black .

2.7 STEEL FINISHES

A. Surface Preparation: Clean surfaces according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Powder Coating: Immediately after cleaning, apply two-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils. Comply with coating manufacturer's written instructions.

1. Color and Gloss: Black .

C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.

D. High-Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

2.8 VINYL BOARD ON BOARD FENCE

A. Basis of Design Product: Subject to compliance with the requirements, provide Hoover Fence Co.; Chesterfield w/ CeraGrain Wood Texture or comparable product

B. Vinyl Fencing and vehicular gate for perimeter fence
   a. Height: 6 feet
   b. Color: Natural Clay
   c. 5” square post
   d. Steel rail channel top and bottom

PART 3 - EXECUTION

3.1 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Post Setting: Set posts in concrete footings at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
3. Space posts uniformly at 8 feet o.c. or as indicated on drawings.

3.2 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.3 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet .

a. Gates and Other Fence Openings: Ground fence on each side of opening. Bond metal gates to gate posts.

B. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

C. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

D. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

E. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

END OF SECTION 323119

SECTION 328400

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: performance requirements for design and installation of complete planting irrigation system.

1.3 PERFORMANCE REQUIREMENTS

A. Provide all components required for a high efficiency, weather-based irrigation system, utilizing drip, micro-misters, subsurface and spray head/rotor irrigation where applicable, soil moisture, rainfall sensors, weather station, and smart controllers throughout.

B. Irrigation zone control shall be automatic operation with controller and automatic control valves.

C. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Submit complete shop drawings to include all irrigation system components including controllers, valves, piping and tubing, emitters, misters, spray heads, valve boxes, etc. Show each irrigation zone and its control valve.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions.

B. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinklers controllers and automatic control valves to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer, with thorough knowledge of the design and installation of irrigation systems for both planting areas and athletic fields.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager Owner no fewer than four days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's , Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Galvanized-Steel Pipe: ASTM A 53/A 53M, Standard Weight, Type E, Grade B.

C. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.

D. Ductile-Iron Pipe with Push-on Joint: AWWA C151, with push-on-joint bell and spigot ends.

E. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

F. Hard Copper Tube: ASTM B 88, Type L, and ASTM B 88, Type M, water tube, drawn temper.

G. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 160 psig.

H. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.

2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 AUTOMATIC CONTROL VALVES

A. Bronze, Automatic Control Valves:

1. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

2.4 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.

2.5 TRANSITION FITTINGS

A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

2.7 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

2.8 QUICK COUPLERS

A. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

2.9 DRIP IRRIGATION SPECIALTIES

A. Freestanding Emitters: Device to deliver water at approximately 20 psig.
B. Manifold Emitter Systems: Manifold with tubing and emitters.
C. Multiple-Outlet Emitter Systems: Emitter with tubing and button-type outlets.
D. Drip Tubes with Direct-Attached Emitters:
E. Drip Tubes with Remote Discharge:
F. Off-Ground Supports: Plastic stakes.
G. Application Pressure Regulators: Brass or plastic housing, NPS 3/4, with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig.
H. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.
I. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.
J. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

2.10 CONTROLLERS

A. Description:

1. Weather based controller for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.

2. Weather / climate based sensors to include soil moisture sensors, rainfall sensors, or connection to a weather station; with the abilbity to interrupt or modify irrigation schedules.
3. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.

a. Body Material: Stainless-steel sheet metal.

4. Interior Control Enclosures: NEMA 250, Type 12, dripproof, with locking cover and two matching keys.

   a. Body Material: Stainless-steel sheet metal.

5. Control Transformer: 24-V secondary, with primary fuse.

6. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.

   a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
   b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
   c. Surge Protection: Metal-oxide-varistor type on each station and primary power.

2.11 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:

   1. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

B. Polymer-Concrete Boxes:

   1. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

C. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.

C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches, to below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

3.2 PIPING INSTALLATION

A. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
B. Install piping free of sags and bends.

C. Install groups of pipes parallel to each other, spaced to permit valve servicing.
D. Install fittings for changes in direction and branch connections.
E. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.
F. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.
G. Install underground thermoplastic piping according to ASTM D 2774.
H. Install expansion loops in control-valve boxes for plastic piping.
I. Lay piping on solid subbase, uniformly sloped without humps or depressions.
J. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.
K. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.
L. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
M. Install piping in sleeves under parking lots, roadways, and sidewalks.
N. Install sleeves made of Schedule 80 PVC pipe and socket fittings, and solvent-cemented joints.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.

F. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.

G. Copper-Tubing Soldered Joints: Apply ASTM B 813 water-flushable flux to tube end unless otherwise indicated.

3.4 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

C. Aboveground Valves: Install as components of connected piping system.

D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves.

E. Throttling Valves: Install in underground piping in boxes for automatic control valves.

F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

3.6 DRIP IRRIGATION SPECIALTY INSTALLATION

A. Install freestanding emitters on pipe riser to mounting height indicated.

B. Install manifold emitter systems with tubing to emitters. Plug unused manifold outlets. Install emitters on off-ground supports at height indicated.

C. Install multiple-outlet emitter systems with tubing to outlets. Plug unused emitter outlets. Install outlets on off-ground supports at height indicated.

D. Install drip tubes with direct-attached emitters on ground.

E. Install drip tubes with remote-discharge on ground with outlets on off-ground supports at height indicated.

F. Install off-ground supports of length required for indicated mounted height of device.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 312000 "Earth Moving" for warning tapes.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation. Confirm that weather based components are operational.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Any irrigation product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that controllers are installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.10 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted abovecground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.11 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

END OF SECTION 328400

SECTION 329200

MEADOW PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this Section consists of all labor, materials, equipment, and services necessary for and incidental to the establishment of meadow areas as indicated on the Contract Plans and specified herein. The work includes:
   1. Weed removal
   2. Native grass and wildflower planting
   3. Maintenance

B. Related Sections
   1. Division 32 Section “Planting”

1.2 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity and weed seed and stating certification by a State Board of Agriculture Seed Certification Program. Include the year of production and date of packaging.

B. Qualification Data: For qualified Landscape / Meadow Installer; for licensed Herbicide Applicator.

C. Soil Test Reports: For existing in-place soil.

D. Schedule and methodology for weed removal: provide information on method of weed removal and number of herbicide applications required based on site conditions prior to planting, and coordinated with site availability and overall construction schedule.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of meadows during a calendar year. Submit before expiration of required maintenance period.

1.3 QUALITY ASSURANCE

A. Installer shall have not less than 5 years documented successful experience in meadow installations. Installer shall submit evidence of qualifications including photographs, locations and references of owners for review by the Landscape Architect and the Owners Representative.

B. Herbicide Applicator: shall have a commercial State license for herbicide application

C. Quality Control of Seed: Seed lots must be State Certified and blended under the supervision of the Delaware Department of Agriculture, Seed Certification Program Seed or other approved State agency. Seed shall be packed 50 lbs. net weight and packed in new, clean, poly woven bags, tightly woven to prevent leaking and contamination. Each container must have permanently affixed to it an accurate analysis tag, a certification tag, and a project name tag.

D. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

E. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. A minimum of four representative samples shall be taken from varied locations from existing soil, location and depth as directed by Architect.

2. Report suitability of tested soil for meadow grass and wildflower growth.

a. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide recommendations for corrective action.

1.4 DELIVERY, STORAGE AND HANDLING

A. Seed and other packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, and name and address of manufacturer. Protect seed and other materials from damage and deterioration during delivery and while stored at the project site.

1.5 PROJECT CONDITIONS

A. Planting Time For Native Grasses and Wildflowers: All seeding shall be done only between April 15 to May 30 or September 15 – October 15. If the construction schedule does not allow installation during the specified seeding times, the meadow areas shall be seeded with annual cover crop until the next planting season.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions. No seeding shall be done during windy weather or when the ground is wet or otherwise unsuitable.

C. All areas shall be inspected by the Landscape Installer before starting any work and any defects in existing soil areas shall be reported to the Architect prior to beginning this work. The commencement of work by the Landscape Installer shall indicate his acceptance of the areas to be maintained or planted and he shall assume full responsibility for the work of this Section.

1.6 ACCEPTANCE, WARRANTY AND MAINTENANCE SERVICE

A. At the completion of meadow planting, an inspection of the work shall be conducted by the Architect and Owner's representative for the purpose of initial acceptance. Any outstanding items revealed on inspection and identified on the punch list shall be corrected within two weeks. Initial acceptance will be withheld until those items are completed. Initial acceptance can be on partially completed work.

B. Initial Meadow Maintenance Service: Provide full maintenance by skilled employees of Landscape / Meadow Installer or as directed by the Landscape / Meadow Installer.. Maintain as required in Part 3. Begin maintenance immediately and continue until acceptable meadow is established, for a minimum of **two years** from date of initial acceptance.

C. Warrant in writing that all meadow planting placed on this Project will be in a healthy vigorous condition at the end of the maintenance service period. Warranty shall not include damage or loss of plants due to vandalism, fire, severe winds, extreme cold, or negligence on the Owner's part.

D. Final Inspection and Acceptance: An inspection will be conducted with the Landscape Installer, Architect and Owner's Representative at the end of the two year maintenance period for purposes of Final Acceptance.

E. Owner's maintenance will begin at the end of the required Landscape Installer maintenance period.

F. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seed: All seed shall be certified and shall be current season crop furnished in sealed standard containers. Seed that has become wet or otherwise damaged will not be acceptable for use. . The aggregate percentage of material, other than specified grass seed in the mixture shall include not more than 18 percent non-viable seed, chaff, hulls, live seed of crop plants (other than those specified), harmless inert matter and weed seed not exceeding 0.50 percent of the total weight of the mixture.

B. Provide the following seed mixtures:

1. Short Grass Meadow and Wildflower mix

Botanical Name	Common Name	Percent
Grasses		
Andropogon glomeratus	Bushy Broomsedge	5
Andropogon ternarius	Splitbeard Broomsedge	5
Eragrostis spectabilis	Purple Lovegrass	5
Festuca brevipila	Hard Fescue	8
Festuca ovina	Sheep Fescue	7
Schizachyrium scoparium	Little Bluestem	30
		60
Forbs		
Asclepias tuberosa	Butterfly Weed	2
Aster pilosus	Heath Aster	1
Aster laevis	Smooth Blue Aster	3
Chaemecrista fasiculata	Partridge Pea	3
Chrysanthemum leucanthemum	Oxeye Daisy	3
Coreopsis lanceolata	Lance-leaved Coreopsis	3
Coreopsis tinctoria	Plains Coreopsis	2
Echinacea purpurea	Purple Coneflower	4
Eupatorium coelistinum	Mistflower	2
Euthamia graminifolia	Narrow-leaved Goldenrod	1
Liatris graminifolia	Narrowleaved Gayfeather	2
Lupinus perennis	Wild Blue Lupine	4
Monarda fistulosa	Wild Bergamot	1
Monarda punctata	Spotted Bergamot	1
Penstemon digitalis	Beardtongue	2
Pycnanthemum virginianum	Virginia Mountain Mint	1
Rudbeckia hirta	Blackeyed Susan	2
Rudbeckia triloba	Browneyed Susan	2
		40

2. Tall Grass Meadow and Wildflower Mix

Botanical Name	Common Name	Percent
Grasses		
Andropogon glomeratus	Bushy Broomsedge	5
Andropogon ternarius	Splitbeard Broomsedge	5
Elymus canadensis	Canada Wild Rye	15
Elymus virginicus	Virginia Wild Rye	15
Schizachyrium scoparium	Little Bluestem	30
Sorghastrum nutans	Indian Grass	5
Tridens flavus	Purpletop	5
		80
Forbs		
Aster pilosus	Heath Aster	1
Aster laevis	Smooth Blue Aster	2
Aster novae-angliae	New England Aster	2

Chrysanthemum leucanthemum	Oxeye Daisy	2
Coreopsis lanceolata	Lance-leaved Coreopsis	1
Coreopsis tinctoria	Plains Coreopsis	1
Desmodium canadense	Showy Ticktrefoil	2
Euthamia graminifolia	Narrow-leaved Goldenrod	1
Heliopsis helianthoides	Oxeye Sunflower	2
Penstemon digitalis	Beardtongue	1
Rudbeckia hirta	Blackeyed Susan	1
Rudbeckia triloba	Browneyed Susan	1
Senna marilandica	Maryland Senna	2
Verbena hastata	Blue Vervain	1
		20

C. Annual cover grass: Incorporate annual cover crop per recommendation of Ernst Seed, alternative supplier, or Landscape / Meadow Installer. If annual cover crop is required for sediment erosion control, coordinate with specifications for SEC seeding.
   1. Summer seeding: Browntop or Italian millet
   2. Spring or fall seeding: Annual oats

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to site preparation operations (herbicide application) the ground surface shall be well drained, cleared of all excess dead weeds, brush, roots, and stones larger than 2 inches in diameter, or any other material which may hinder proper seeding or subsequent maintenance operations.

B. Weed removal: All weeds must be killed prior to planting of meadow grasses. Mow two weeks before herbicide application. Apply glyphosate (Roundup) per manufacturers recommendation, only when plants are actively growing, under appropriate climatic conditions. Application must be done by a licensed spray technician.

C. Based on the extent of weed growth, multiple applications of glyphosate will be required, at a minimum of four weeks apart.

D. Do not till areas being treated with herbicide in preparation for meadow seed planting.

3.2 SEEDING PROCEDURES

A. General: Seeding will be done using an approved native grass drill seeder (Truax brand or equivalent) or other approved methods.

B. Drill seeding: provisions shall be made by markers or other means to assure that successive seeded strips will overlap or be separated by a space not greater than the space between rows planted by the equipment being used. If inspection reveals, during planting operations or after, that strips wider than the space between the rows planted have been left unplanted, or that other areas have been skipped, the Owner’s Representative will require the sowing of additional seed on these areas.

C. Broadcast seeding: Preceed broadcast seeding by scarification of the surface using a drag harrow. Follow the broadcast seeding with two passes with a cultipacker.

D. Hydroseeding will not be allowed for native grass and wildflower seed.

E. When conditions are such, by reason of drought, high winds, excessive moisture, or other factors that satisfactory results are not likely to be obtained, stop the work and resume only when conditions are favorable.

F. Using a drill seeder, drill to a depth of 1/4-inch. Seed shall be drilled twice at half rate - the second drilling shall be performed in a direction perpendicular to the first.

G. Meadow seed shall be applied at the rate 15 bulk pounds per acre.

H. Temporary Seeding: Annual cover crops shall be seeded at a rate of 20-30 lbs per acre based on species and seed suppliers recommendation.

3.3 MAINTENANCE

A. General: The Landscape Installer shall be responsible for the proper care and maintenance of the seeded areas until the completion of the two year maintenance service period and Final Acceptance.

B. Maintenance shall consist of repair and replanting of eroded areas, removal of invasive species and annual weeds, watering if required, reseeding and mowing, as necessary to provide an even, full thick and healthy fixed growth of meadow grass

C. The Landscape Installer shall provide at his own expense protection against trespassing and damage to seeded areas and planted areas until they are accepted. Provide barricades, temporary fencing, signs as required to protect such seeded areas until accepted.

D. The Landscape Installer will not be responsible for damage to meadow plantings due to extreme weather other than drought, acts of vandalism, or other circumstances beyond the Landscape Installers control.

E. Watering: Watering will be required only in case of extreme summer drought conditions.

F. Mowing and weeding; Observation of the desired species growth and weed competition is essential.
   1. First growing season: When undesirable vegetation reaches 12 – 18” tall, mow to no less than 6” high to prevent annual weeds from developing seeds. Mow three times minimum. Spot weed and spot herbicide weeds.
   2. Second growing season: mow one time in early spring to no less than 6 inches high and spot weed and spot herbicide annual weeds.

G. Weed removal: for persistent or noxious weeds, spot application of glyphosate may be required.

H. REPAIR

1. During the maintenance period, all areas and parts of areas which, in the opinion of the Owner's Representative, fail to show a uniform stand of meadow, shall be reseeded, and such areas and parts of areas shall be seeded repeatedly until all areas are covered with a satisfactory growth. Reseeding shall be done at the expense of the Landscape Installer by spreading the seed by an approved method and during an approved season.
2. If the stand is over 60% damaged, or meadow is dominated by invasive weeds, re-establish, following original weed removal, seedbed preparation, and seeding recommendations.

3.4 FINAL ACCEPTANCE

A. Acceptable meadows shall be that which is healthy and vigorous and covering 95 percent of the soil surface in unit increments of 1 square yard with an allowable weed content not to exceed 5 percent.

END OF SECTION

SECTION 329223

LAWNS

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this Section consists of all labor, materials, equipment, and services necessary for and incidental to the establishment of lawn areas as indicated on the Contract Plans and specified herein. The work includes:
   1. Weed removal
   2. Soil amendments
   3. Grass planting (from seed)
   4. Grass planting
   5. Maintenance

B. Related Sections
   1. Division 32 Section “Planting”
   2. Division 32 Section “Meadow Planting"

1.2 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed, in accordance with the Federal Seed Act, and stating certification by the Delaware State Board of Agriculture Seed Certification Program. Include the year of production and date of packaging.

B. Mulching materials: The Contractor shall provide submittals of manufacturer’s / suppliers specifications for all mulching material.

C. Qualification Data: For qualified landscape Installer.

D. Soil Test Reports: For subgrade, stockpiled onsite topsoil and imported topsoil.

E. Schedule and methodology for weed removal: provide information on method of weed removal and number of herbicide applications required based on site conditions prior to planting.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

1.3 QUALITY ASSURANCE

A. Installer shall have not less than 5 years documented successful experience in lawn and seeding installations and be a member of the Landscape Contractors Association. Installer shall submit evidence of qualifications including photographs, locations and references of owners for review by the Landscape Architect and the Owners Representative. Installer must exhibit previous successful installations of Bermuda grass turf athletic fields.

B. Quality Control of Seed: Seed lots must be State Certified and blended under the supervision of the Delaware Department of Agriculture, Seed Certification Program Seed. Seed shall be packed 50 lbs. net weight and packed in new, clean, poly woven bags, tightly woven to prevent leaking and contamination. Each container must have permanently affixed to it an accurate analysis tag, a certification tag, and a project name tag.

C. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

D. Soil Analysis: see requirements of Section 329300

1.4 DELIVERY, STORAGE, AND HANDLING

A. Seed and other packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, and name and address of manufacturer. Protect seed and other materials from damage and deterioration during delivery and while stored at the project site.

1.5 PROJECT CONDITIONS

A. Site conditions: All areas shall be inspected by the Contractor before starting any work and any defects in planting areas shall be reported to the Landscape Architect prior to beginning this work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be maintained or planted and he shall assume full responsibility for the work of this Section.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions. No seeding shall be done during windy weather or when the ground is wet or otherwise unsuitable.

C. The Contractor is responsible for the protection of existing structures, utilities, existing plant material and other landscape features during lawn installation.

1.6 MAINTENANCE SERVICE

A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after

each area is planted and continue until acceptable lawn is established, and at least until completion of building construction.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 ACCEPTANCE AND WARRANTY

A. At the end of the maintenance period, an inspection of work completed shall be conducted by the Landscape Architect and Owner's Representative for the purpose of initial acceptance. Any outstanding items revealed on inspection and identified on the punch list shall be corrected within two weeks. Initial acceptance shall be withheld until those items are completed. Acceptance can be on partially completed work. Warranty, for a period of one year, shall begin after landscape inspection and initial acceptance.

B. Warrant in writing that all plant material placed on this Project will remain alive and be in healthy vigorous condition for a period of 1 year after completion and initial acceptance of entire project.

C. During the warranty period replace, in accordance with the drawings and specifications, all lawn areas that are in an unhealthy or unsightly condition, or more than 25% dead.

D. Final Inspection and Acceptance: An inspection will be conducted with the Landscape Contractor, Landscape Architect and Owner at the end of the one year warranty period for purposes of Final Acceptance.

E. Warranty shall not include damage or loss of plants due to vandalism, fire, severe winds, extreme cold, or negligence on the Owner's part.

F. Owners Maintenance will begin at the end of the required contractor maintenance period.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Lawn seed species for general lawn areas: State certified seed of grass species as follows:
   1. Provide "Rebel IV" Fescue or equal
      a. 95% tall fescue
      b. 5% Kentucky bluegrass

C. Lawn seed species for practice athletic fields and baseball/softball outfields: State certified seed of grass species as follows:
   1. Provide “Riviera” Bermuda grass

D. Lawn sod species for baseball/softball infields: State certified sod of grass species as follows:
   1. Provide “Riviera” Bermuda grass

E. Lawn seed species for practice athletic fields and baseball/softball outfields (annual overseeding only):
   1. Provide annual ryegrass

F. Turf seed mix for bioswales: State certified seed as follows:
   1. Provide Wet Tolerant Seed Mix #14 per DNREC handbook.

G. Mulch:

   1. Mulch shall be clean threshed, straw of oats, wheat barley or rye is acceptable. Mulch shall be free of noxious weeds and seeds. Mulch shall be visually inspected to ensure that it is free from mold, foreign substances, weeds and that it is an air-dry condition suitable for placing with mulch blower equipment.

   2. Tackifier shall be Terra Tack Binders or equal as is manufactured by Grass Growers of Plainfield, New Jersey.

2.2 CHEMICAL AMENDMENTS

A. Rates of all chemical amendment shall be based on soil test and recommendations.

B. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 sieve and a minimum 75 percent passing a No. 60 sieve.

   1. Provide lime in the form of dolomitic limestone.

C. Aluminum Sulfate: Commercial grade, unadulterated.

D. Iron Sulfate (Ferris or Ferrous): Shall contain 30-35 percent iron, 35-50 percent sulfur and be supplied by a commercial fertilizer supplier.

E. Sulfate of Potash: Agricultural grade containing 50-53 percent of water soluble potash.

2.4 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:

1. Composition: 1 lb. per 1,000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

B. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

3. Composition: 10 percent nitrogen, 5 percent phosphorous, and 5 percent potassium, by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive Lawn for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 LAWN PREPARATION

A. Weed removal: All weeds must be removed prior to planting of lawns. Mow closely two weeks before herbicide application. Apply glyphosate (Roundup) per manufacturers recommendation, only when plants are actively growing. Application must be done by a licensed spray technician. Based on the extent of weed growth, multiple applications of glyphosate may be required, at least two weeks apart.

B. Till subgrade to a minimum depth of 3 inches. Remove stones larger than 1-1/2 inches.

C. Spread planting soil to a depth as shown on drawings but not less than required to meet finish grades after light rolling and natural settlement. Mix into subgrade. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

E. Rake in required lime, fertilizer and soil amendments to a depth of 3” to 4” and rake smooth

F. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.2 SEEDING

A. Do not use wet seed or seed which is moldy or otherwise damaged in transit or storage.

B. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 mile per hour. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.

C. Sow not less than the quantity of seed specified or scheduled.
   1. Fescue Sowing Rate: Sow grass seed at the following rates: Sow mixture at 9lbs. per 1000 sq. ft.
   2. Bermuda grass Sowing Rate: Sow grass seed at the following rates: Sow mixture at 2-3 lbs. per 1000 sq. ft.

D. Rake seed lightly into top 1/8’ of soil, roll lightly, and water with a fine spray.

E. Protect seeded areas against erosion by spreading specified lawn mulch after completion of seeding operations. Spread uniformly t form a continuous blanket not less than 1-1/2” loose measurement over seeded areas.

F. Water newly planted areas.

3.3 MULCHING

A. Mulch shall be required on all surfaces immediately after seeding.

B. If mulch is displaced before a growth of 1-inch to 1-1/2 inches is obtained, it shall be replaced by the Contractor at no extra expense.

C. Seeded areas shall be mulched with thrashed barley, wheat or oat straw and secured by Terra Tack Binders or equal as is manufactured by Grass Growers of Plainfield, New Jersey.

3.4 MAINTENANCE

A. Maintenance shall consist of repair and replacement of eroded areas, weeding, watering, reseeding and remulching, as necessary to provide an even, full thick and healthy fixed growth of turf grass.

B. The Contractor shall provide at his own expense protection against trespassing and damage to seeded areas and planted areas until they are accepted. Provide barricades, temporary fencing, signs or policing as required to protect such seeded areas until accepted.

C. The Contractor will be responsible for normal tenant, poor weather and other damages to lawns until the time of acceptance by the Owner.
   1. Damages due to circumstances beyond the Contractor's control (i.e., vandalism) will be repaired after requesting a change order and obtaining approval of same.

D. Watering:
   1. First Week: The Contractor shall provide all labor and furnish all watering necessary for establishment of the seed. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least 4 inches.

2. During growing seasons: The Contractor shall water the lawn as required to maintain adequate moisture in the upper 4 inches of soil necessary for the promotion of deep root growth. New grass must not be allowed to dry out.

3. Water with a fine spray.

E. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
   1. Mow turf-type tall fescue to a height of 2 to 3 inches.
   2. Mow turf-type Bermuda grass to the following heights:
      a. Practice athletic fields: 1.5”
      b. Baseball/Softball Infields: ¾”-1”
      c. Baseball/Softball Outlfields: 1.5”-2”

F. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

3.5 REPAIR

A. After the grass in seeded areas has appeared, all areas and parts of areas which, in the opinion of the Owner's Representative, fail to show a uniform stand of lawn, for any reason whatsoever, shall be reseeded, and mulched and such areas and parts of areas shall be seeded repeatedly until all areas are covered with a satisfactory growth. Reseeding shall be done at the expense of the Contractor by spreading the seed by an approved method and during an approved season.

B. If stand is over 60% damaged, or lawn is dominated by invasive weeds, re-establish, following original weed removal, seedbed preparation, and seeding recommendations.

3.5 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly seeded areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION

SECTION 329300

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this Section consists of all labor, materials, equipment, and services necessary for and incidental to the establishment of tree planting as indicated on the Contract Plans and specified herein. The work includes:
   1. Deciduous and evergreen tree planting
   2. Maintenance

B. Related sections include:
   1. Division 32 Section “Meadow Planting”
   2. Division 32 Section “Lawns”

1.2 SUBMITTALS

A. Submit a list of all nurseries that will supply plants.

B. Qualification Data: For qualified landscape Installer.

C. Soil Test Reports: For existing in-place soil and imported topsoil

D. Submit one-pound samples of all topsoil, organic material, sand and soil additive products in this section. Samples should be labeled to include the location of the source of the material. Samples of all topsoil shall be submitted at the same time as the particle size and physical analysis.

E. Submit the manufactures particle size analysis for all sands and lightweight aggregate if required.

F. Submit the manufactures particle size analysis, pH and certificate of length of composting period for all pine bark and other organic materials.

G. Plant Photographs: Submit color photographs of representative specimens of each type of tree on the plant list. Photos shall be 3”x5” taken from an angle that depicts the size and condition of the typical plant to be furnished. A scale rod or other measuring device shall be included in the photograph. Label each photograph with the plant name, size and name of growing nursery.

H. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall have not less than 5 years documented successful experience in meadow installations and be a member of the Landscape Contractors Association. Installer shall submit evidence of qualifications including photographs, locations and references of owners for review by the Landscape Architect and the Owners Representative.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Sampling and Testing:

1. Provide soil analysis of soil samples taken after rough grading and before placement of topsoil and amendments:
   a. Six samples from turf areas; three to be from athletic field locations
   b. Three samples from planting areas adjacent to building
   c. Three samples from meadow area

2. Provide soil analysis of on-site stockpiled topsoil, imported topsoil and compost.
   a. Three samples from on-site stockpiled topsoil
   b. One sample for each 500 cy of imported topsoil and compost
   c. Provide new samples if soil supplier changes during application.

3. Procedures and Depth of Samples: Per methodology recommended by testing laboratory

4. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.

5. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

D. General: Perform tests on soil samples according to requirements in this article. Report suitability and provide recommendations of tested soil for planting type – turf, planting or meadow.

E. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

   a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
   b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."

3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."

F. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

G. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

H. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

I. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.

2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

J. All testing will be at the expense of the Contractor.

K. Plant material observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Landscape Architect two weeks in advance of plant observation / tagging schedule.
2. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

L. The contractor shall maintain continuously a competent supervisor, satisfactory to the Owner's Representative, with authority to act in all matter pertaining to this work.

M. Conference: Before any work is started a conference shall be held between the Contractor, the Owner's Representative and the Landscape Architect concerning the work under this contract.

N. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

O. It is the Landscape Contractor's responsibility to coordinate and cooperate with the other Contractors to enable work to proceed rapidly and efficiently. Coordinate with all adjacent Contractors' work including all paving, lawn, electrical, etc.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

B. Do not prune trees and shrubs before delivery except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery.

C. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist. Plants shall not be stored on site longer than 1 week.

1.5 PROJECT CONDITIONS

A. Plant material should be installed within the following dates: March 1 – July 1 or September 1 – November 15, or as approved by the Landscape Architect. Plant material may not be dug after May 15.

1. If the plants are installed outside of the designated planting season, the contractor is responsible for providing an additional 9 month warranty..

B. Weather limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

C. Coordination with meadow areas: Plant trees, shrubs and other plants after finish grades are established and before planting meadow areas unless otherwise indicated.
1. When planting trees, shrubs and other plants after planting meadow areas, and promptly repair damage caused by planting operations.

1.6 MAINTENANCE SERVICE

A. Initial Planting Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until completion of building construction and initial acceptance.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 ACCEPTANCE AND WARRANTY

A. An inspection of work completed shall be conducted by the Landscape Architect and Owner's Representative for the purpose of initial acceptance. Any outstanding items revealed on inspection and identified on the punch list shall be corrected with two weeks. Initial acceptance shall be withheld until those items are completed. Acceptance can be on partially completed work. Warranty, for a period of one year, shall begin after landscape inspection and initial acceptance.

B. Warrant in writing that all plant material, including groundcovers, placed on this Project will remain alive and be in healthy vigorous condition for a period of 1 year after completion and initial acceptance of entire project.

C. During the warranty period replace, in accordance with the drawings and specifications, all plants that are in an unhealthy or unsightly condition, or more than 25% dead. Warrant all replacement trees for an additional one year period.

D. Final Inspection and Acceptance: An inspection will be conducted with the Landscape Contractor, Landscape Architect and Owner at the end of the one year warranty period for purposes of Final Acceptance.

E. Warranty shall not include damage or loss of plants due to vandalism, fire, severe winds, extreme cold, or negligence on the Owner's part.

F. Owners maintenance shall begin upon initial acceptance of plant material.

PART 2 - PRODUCTS

2.1 TREE MATERIAL

A. General: Furnish nursery-grown trees complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Root balls shall comply with ANSI 260.1 standards and shall meet sizes laid out in the ANSI 260.1 standards as well as being intact and undamaged when they arrive on the site. Trees that have deteriorated root balls will not be accepted.

B. If formal arrangements or consecutive order of trees shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.2 SHADE TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

1. Provide balled and burlapped trees.
2. All trees shall have their north side marked in the nursery prior to digging. Set trees in the hole with the marker facing north.

2.3 EVERGREENS

A. Form and Size: Normal-quality, well-balanced, unsheared evergreens, of type, height, spread, and shape required.

2.4 TOPSOIL

A. Topsoil: Utilize existing/ onsite topsoil if deemed suitable. Provide new topsoil that is fertile, friable, natural loam, surface soil, free of subsoil, clay lumps, weeds and other litter, and free of stones and other debris over 1-1/2” and other toxic substances harmful to plant growth. Topsoil shall have a pH range of 5.0 – 7.0.

1. Existing topsoil may require screening to meet the requirements of the specifications. Soil debris can comprise no more than 10% by weight and soil shall exceed a 4.75 mm (No 4) sieve and shall be free of other toxic substances harmful to plant growth.
2. Imported topsoil shall be obtained from an area that has never been stripped.

2.5 PLANT MIX FOR TREE PITS AND SHRUB BEDS

A. Tree Planting Mix: Mix 1/3 topsoil, 1/3 organic material and 1/3 existing soil by volume, based on approval of Landscape Architect. Topsoil to be onsite or imported topsoil. Additional amendments or adjustments to the planting mix to be determined by soil test recommendations.

B. Shrub Planting Mix: Mix 2/3 topsoil and 1/3 organic material by volume. Topsoil to be onsite or imported topsoil. Additional amendments or adjustments to the planting mix are to be determined by soil test recommendations.

C. SOIL AMENDMENTS
1. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent Applications shall be determined by soil test recommendations to raise pH.
2. Ground sulphur: Applications shall be determined by soil test recommendations to lower pH.
3. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.6 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight. Organic matter to be “Leaf Gro Compost” or approved equal.

2.7 FERTILIZER

A. All fertilizers shall be uniform in composition, free flowing and suitable for application with approved equipment. Applications shall be determined by soil test recommendations.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium.

C. Slow-Release Fertilizer: Granular or pellet fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium.

D. Planting tablets: Tightly compressed chip type, long lasting, slow release, commercial grade planting fertilizer in tablet form.

2.8 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of shredded hardwood. Natural color only.

2.9 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch by length indicated, pointed at one end.

B. Guys and Tie Wires: No. 12 gauge galvanized wire.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.2 TREE PIT EXCAVATION

A. Tree Pits: Excavate circular pits with sides sloped inward, as shown on the Drawings. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
   1. Excavate approximately two times as wide as ball diameter.
   2. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
   3. Do not excavate subgrades of adjacent paving, structures, hardscapes or other new or existing improvements.

B. Tree Pits within Paving: Tree pits within paved areas shall be excavated to the extents of surrounding paving and to depth specified.

C. Subsoil and topsoil from excavations may be used as a component of the planting soil upon approval of the Landscape Architect.

D. Notify Landscape Architect if unexpected rock, obstructions or impermeable soils detrimental to trees or shrubs are encountered in excavations. Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

3.3 TREE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements. Do not use planting stock if root ball is cracked or broken before or during planting operation.

B. Set plants to the elevations shown on the drawings. Place a maximum 2” soil on top of root ball. Set trees on compacted pads as shown. Use plant mix specified to backfill pit approximately 2/3 full. Water thoroughly before installing remainder of the plant mix to top of pit, eliminating all air pockets. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

C. Place planting tablets in each tree planting pit when pit is approximately one half filled, in amounts recommended in soils reports from soil testing laboratory. Place tablets beside the root ball about one inch from root tips.

D. Cut ropes and strings from top of tree root balls after plant has been set. Remove burlap or cloth wrapping from around top half of balls, do not remove from under root balls. Do not turn under and bury any portion of burlap.

E. Smooth planting areas to conform to the grades indicated after full settlement has occurred and mulch has been applied. Thoroughly water plants after mulching.

3.4 TREE PRUNING

A. Prune, thin, and shape trees as only as directed by Landscape Architect.

3.5 SHRUB PLANTING

A. Preparation of planting beds: Excavate entire planting bed to specified depths as shown on Drawings. Till subsurface to a depth of 6 inches. Place planting soil per specified depths, allowing for settlement.

B. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in shrub planting beds.

C. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

D. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

E. Balled and Burlapped and container stock: Set each plant plumb with root flare 2 inches above adjacent finish grades.

F. Mulch entire planting bed with mulch. Thoroughly water plants after mulching.

3.6 GUYING AND STAKING

A. Stake trees as shown on drawings.

3.7 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.8 MAINTENANCE

A. Contractor is responsible for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insets and disease.

1. Maintenance Period: Until completion of building construction and initial acceptance of all plant material.

B. Maintenance between initial acceptance and final acceptance shall be the responsibility of the Owner.

END OF SECTION 02930

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Grout.
2. Flowable fill.
3. Piped utility demolition.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi , 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.2 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft..
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Water: Comply with ASTM C 94/C 94M.
5. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 330500

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Precast concrete manholes.
2. Trench drain
3. Storm drain pipe and appurtenances

1.3 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least watertight, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Storm drain pipe.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers.
2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.

C. Field quality-control test reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle manholes according to manufacturer's written rigging instructions.

C. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

D. Handle downspout boots according to manufacturer’s written instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager Owner no fewer than five days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's written permission.

B. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that Storm Drainage System piping may be installed in compliance with original design and referenced standards.

1. Locate existing Storm Drainage System piping and structures that are to be abandoned and closed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 48 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Watertight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
3. Watertight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

B. Corrugated PE Pipe and Fittings NPS 56 and NPS 60: AASHTO MP7, Type S, with smooth waterway for coupling joints.

1. Watertight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.4 REINFORCED CONCRETE PIPE:

1. Materials shall be in accordance with ASSHTO M-170.
2. Pipe class shall be Class III unless otherwise indicated on the drawings.
3. Joints to be tongue and groove.
4. Joining material may be either:

a. Portland cement mortar consisting of 1 part Portland cement, 2 parts sand and enough water to provide a workable mix, or
b. Bitumastic joint filler equal to Ram-Neck.

5. Joints shall be watertight under full flow conditions.

2.5 PVC GRAVITY SEWER PIPING:

1. Pipe and Fittings: ASTM F 679, T-2 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.6 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, rubber.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.7 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast reinforced concrete, of depth indicated with provision for rubber gasket joints.

1. Base Section: 8-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
2. Riser Sections: 5-inch minimum thickness; 48-inch diameter, and lengths to provide depth indicated.
3. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone to match grade rings.
4. Grade Rings: Provide 2 or 3 reinforced concrete rings, with 12 maximum inches total thickness and match 24-inch diameter frame and cover.
5. Gaskets: ASTM C 443, rubber.
6. Steps: Cast into base, riser, and top sections sidewall at 12-to 16-inch intervals.
7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
8. Channel and Bench: Concrete or Brick.
9. Coat Exterior Surface with two (2) coats of coal-tar epoxy, 15 mil. Minimum thickness.

B. Manhole Steps: Wide enough for a man to place both feet on one step and designed to prevent lateral slippage off the step.

1. Material: Steel-reinforced plastic.
2. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, heavy-duty, ductile iron, 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover, indented top design, with lettering "STORMDRAIN" cast into cover.

2.8 CATCH BASINS & INLETS

A. Standard Precast Concrete Catch Basins & inlets: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Catch basins & inlets shall be according to the local utility standard as noted on the structure schedule.

1. All materials for catch basins, steps, frames and grates, curb inlets and other appurtences and incidentals shall conform to Section 708 of DelDOT Specifications and Standard Details for structures noted as DelDOT structures on the plans.

B. Standard PVC Surface Drainage Inlets and In-Line Drains as indicated on the drawings.

1. Ductile Iron Grates shall be considered an integral part of the surface drainage structure and shall be furnished by the same manufacturer.
2. Structures shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc. or approved equal.

2.9 STORMWATER DETENTION STRUCTURES

A. Cast-in-Place Concrete, Stormwater Detention Structures: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Ballast: Increase thickness of concrete, as required to prevent flotation.
2. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of structure to finished grade is less than 36 inches.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service Include indented top design with lettering "STORM SEWER" cast into cover.

2.10 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

   a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

   a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.11 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

B. Basis-of-Design Product: Subject to compliance with requirements, provide ACO Klassik KS100S sloped channel with ADA compliant stainless steel grates (Class A) at locations shown on the plans or approved comparable product. Provide ACO Sport System 3000 neutral channel with in-line catch basins around the straight and curved areas of the running track as shown on the plans. Provide ACO Sport System 4000 with in-line catch basins and ADA compliant stainless steel grates at Auxiliary Field, baseball field and softball field at the locations shown on the plans.

C. Sloped and Neutral Invert, Polymer-Concrete Systems:

1. Channel Sections:

a. Interlocking-joint, precast, modular units with end caps.
b. 4-inch inside width and deep, rounded bottom. Sloped channels shall have a built-in invert slope of 0.6 percent. Provide outlets in quantities, sizes, and locations indicated. Bottom outlets are to be used unless shown otherwise. Outlets shall include fitting required to transition from oval to round.
c. Extension sections necessary for required depth.
d. Frame: Include stainless steel frame for grate.

2. Grates:

a. Manufacturer's designation ACO Type with ADA compliant slotted openings suitable for use in pedestrian locations that fit recesses in channels.
b. Grates shall be removable for easy access to the channel in order to maintain and clean the system.
c. Material: Stainless steel.

3. Covers: Solid gray iron if indicated.
4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

2.12 FIBERGLASS, PREFABRICATED TRENCH DRAINAGE SYSTEMS

A. General Requirements for Fiberglass, Trench Drainage Systems: Prefabricated system of fiberglass molded into smooth radius sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

B. Basis-of-Design Product: Subject to compliance with requirements, provide DuraTrench true radius sloped channel, with ADA compliant stainless steel grates (Class A) as manufactured by Eric’sons at locations shown on the plans or approved comparable product.

Eric’sons 574C Industrial Way N. Dallas, GA 30132 (770) 505-6575

C. Fiberglass Systems:

1. Channel Sections:

a. Trench drain body shall be composed of polyester fiberglass resin and “E” glass fibers molded into a smooth radius, with built-in invert slope of approximately 1.0 percent.
b. Rounded inside bottom surface, with outlets in quantities, sizes, and locations indicated.
c. The trench body shall mate to the smooth radius frame and form a grate seat that shall accept the specified radius grate. The body shall be supplied with a factory fit top for rail alignment and fastening of the channels in the field ensuring that the rails are cast in a coplanar manner.
d. Shall be frost proof and salt proof.
e. Width: 8 inches.

2. Grates:

a. Grating shall be heavy duty with ADA compliant slotted openings suitable for use in pedestrian locations that fit recesses in channels.
b. Grates shall be removable for easy access to the channel in order to maintain and clean the system.
c. Material: Stainless steel.

3. Covers: Solid gray iron if indicated.

4. Sealant: Joints shall be fully sealed with urethane joint sealant. The joint sealant shall be continuous form the top of the joint through the bottom and back to the top on the other side.

5. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

2.13 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.
d. Tyler Pipe.
e. Watts Water Technologies, Inc.
f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Plastic Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Canplas LLC.
b. IPS Corporation.
c. Nyloplast, a division of Advanced Drainage Systems, Inc.

d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
e. Sioux Chief Manufacturing Company, Inc.
f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Flexible or rigid couplings for same or minor difference OD pipes.

b. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.

c. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

B. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range and material as indicated on drawings:

1. NPS 4 and NPS 36 Corrugated PE drainage pipe and fittings, watertight couplings, and coupled joints.

2. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with groove and tongue ends.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing stormdrain system is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping below frost line.
3. Install corrugated steel piping according to ASTM A 798/A 798M.
4. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
6. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

3.4 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
2. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
3. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.
4. Join corrugated PE piping according to CPPA 100 and the following:

   a. Use watertight couplings for Type 1, watertight joints.

3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections according to ASTM C 891.

3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Install outlets that spill onto grade, anchored with concrete, where indicated.

C. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

D. Construct energy dissipaters at outlets, as indicated.

3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22.

3.10 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.11 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' notice.
4. Submit separate report for each test.

3.13 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100

SECTION 334600 - SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This work shall consist of providing and placing a drainage system comprised of a geo-composite, pre-fabricated, water collection system (collection system) and the associated water transport system (transport pipes) as described in the plans. The drainage system shall be installed in accordance with these specifications and in close conformity with the locations and dimensions as shown on the plans or specified by the engineer. The quantities of drainage system materials as shown on the plans may be increased or decreased at the discretion of the engineer based on actual site conditions that occur during construction of the project. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

B. This Section includes subdrainage systems for the following:

1. Athletic fields.

1.3 DEFINITIONS

A. HDPE: High-density polyethylene plastic.

B. PE: Polyethylene plastic.

C. PP: Polypropylene plastic.

D. PVC: Polyvinyl chloride plastic.

E. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Perforated-wall pipe and fittings.
2. Solid-wall pipe and fittings.
3. Drainage conduits.
4. Drainage panels.
5. Geotextile filter fabrics.

B. Approval of waterproofing manufacturer's service agent for use of drainage panels against and for waterproofing membrane protection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.3 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

2.4 SOLID-WALL PIPES AND FITTINGS

A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

B. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.

C. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.

1. Gaskets: ASTM F 477, elastomeric seal.

2.5 SPECIAL PIPE COUPLINGS

A. The fittings used with the collection system shall be of a snap together design. In no case shall any product be joined without the use of the manufacturer’s connector designed specifically for the purpose.

2.6 CLEANOUTS

A. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.7 DRAINAGE CONDUITS

A. Single-Pipe Drainage Conduits: Prefabricated geocomposite with interconnected, corrugated, perforated-pipe core molded from HDPE with a minimum cell classification of 424420C as defined and described in ASTM D 3350 and wrapped in geotextile filter fabric.

1. Available Manufacturers:

a. Advanced Drainage Systems, Inc. – Advanedge ® or equal.

2. Nominal Size: 12 inches wide by approximately 1 inch thick.

a. Minimum In-Plane Flow: 30 gpm at hydraulic gradient of 1.0 when tested according to ASTM D 4716.

3. Filter Fabric: Nonwoven, needle-punched geotextile.
4. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.
5. Couplings: Corrugated HDPE band.

2.8 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.3 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Add drainage course to top of drainage conduits.

E. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.

F. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

G. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

H. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.4 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated. Edit first subparagraph below as required for different minimum slope and cover.

1. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.

2. Lay perforated pipe with perforations down.

3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. CONSTRUCTION REQUIREMENTS

1. The amount of trench excavated at any time shall not exceed the amount of drain that can be set and backfilled completely in one working day. The trench shall be 4 inches wide and at the depth specified in the plans. The collection system shall be centered in the trench, and backfilled with clean very coarse sand or an alternate selected by the engineer.

2. The trench excavations for the collection system and transport pipe shall be to the lines and grades shown on the plans. Over excavation in the bottom of the excavation shall be backfilled to the proper grade with excavated material or sand prior to the placement of the collection system.

3. Fittings shall be installed in accordance with the manufacturer's recommendations.

4. Backfill shall be consolidated in accordance with the plans or as directed by the engineer.

5. Any damaged collection system or transport pipe shall be replaced or repaired by splicing in an undamaged section of like material.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

3.6 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping.

1. Install PE warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.7 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.8 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600

SECTION 33 71 19

ELECTRICAL UNDERGROUND DUCTS/HANDHOLES/PULL BOXES

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Introductory Information, Bidding Requirements, and Contract Requirements; and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

1.2 SUMMARY

A. Section Includes:
1. Plastic conduit and ductbanks.
2. Precast concrete manholes, pull boxes, and splice boxes.
3. Underground duct markers.
4. Manhole pull/splice box accessories.
5. Handholes.
6. Transformer vault pad.

B. Related Sections:
1. Section 02 41 13 – Selective Site Clearing and Demolition.
2. Section 26 05 00 – Common Work Results for Electrical.
3. Section 31 20 00 – Earthwork.
4. Section 31 25 00 – Soil Erosion and Sediment Control.
5. Section 32 92 00 – Seeding and Mulch.

1.3 REFERENCES

A. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
3. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
4. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
5. ASTM C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures.

B. Institute of Electrical and Electronics Engineers:
1. IEEE C2 - National Electrical Safety Code.

C. National Electrical Manufacturers Association:
   1. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   2. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   3. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
   4. NEMA TC 6 - PVC and ABS Plastic Utilities Duct for Underground Installation.
   5. NEMA TC 9 - Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.
   6. NEMA TC 10 - PVC and ABS Plastic Communications Duct for Underground Installation.
   7. NEMA TC 14 - Filament Wound Reinforced Thermosetting Resin Conduit and Fittings.

D. Underwriters Laboratories Inc.:
   1. UL 651A - Type EB and A Rigid PVC Conduit and HDPE Conduit.

1.4 SYSTEM DESCRIPTION

A. Interconnected system of conduits, manholes, pull/splice boxes, vaults, and handholes to distribute medium-voltage power, low-voltage power, telephone, and data communications.

B. The majority of the underground conduits, manholes, pull/splice boxes, vaults, and handholes are existing and shown as “Light” on the Electrical Site Plans. Contractor shall extend the conduits to their final location (pole fixtures, panels, transformers, switches, receptacles, etc.). Conduits for light fixtures shall be extended from existing handholes. Provide new conduit runs as shown on the drawings. Both the power and control conduits shall be extended to the fixture poles whether or not the control conduit is being used. No existing or new conduit shall be capped below grade unless noted otherwise.

C. Conduit and duct routing and manhole locations are shown in approximate locations unless dimensions are indicated. Coordinate with the Bid Pac ‘C’ contractor for proper placement of underground conduits and to limit excessively long runs.

D. Medium-voltage: Use rigid PVC schedule 40 conduit.

E. Low-voltage: Use rigid PVC schedule 40 conduit.

F. Telephone and data communication: Use rigid PVC schedule 40 conduit.

G. Security systems: Use rigid PVC schedule 40 conduit.

1.5 SUBMITTALS

A. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes and pull/splice boxes, vaults, and handholes.

B. Product Data: Submit for nonmetallic conduit, duct accessories, and manhole, pull/splice box, vaults, and handhole accessories.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes, pull/splice boxes, vaults, and handholes.

B. Submit digital photographs of all work prior back filling. Digital copy of photographs to be submitted to engineer.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum ten years documented experience.

1.8 COORDINATION

A. Coordinate Work with existing underground utilities and structures.

1.9 QUALITY ASSURANCE

A. Comply with the National Electrical Code (NEC) and IEEE C2 – National Electrical Safety Code (NESC) for components and installation.

B. Provide products that are listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) for the application, installation condition, and the environment in which installed.

1.10 RECEIVING, STORING, AND PROTECTING

A. Receive, store, and protect, and handle products according to NECA 1 – Standard Practices for Good Workmanship in Electrical Construction.

PART 2 PRODUCTS

2.1 PLASTIC CONDUIT

A. Manufacturers:
1. Allied Tube and Conduit
2. Carlon
3. Calconduit Products
4. CANTEX

B. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.

2.2 DUCT SPACERS

A. Furnish duct spacers that provide 3-inch separations between conduits.

B. Manufacturers: Underground Devices "Wunpeece".

2.3 CONCRETE

A. Use concrete with maximum 1/2 inch coarse aggregate and Type 1 Portland cement (ASTM C 150 – Standard Specification for Portland Cement) that has a slump of 6 to 7 inches and acquires a compressive strength of 5000 psi in 28 days.

2.4 RACEWAY MEASURING/PULLING TAPE

A. Furnish raceway measuring/pulling tape with permanently printed measurements in one-foot increments and minimum 1200 lb average breaking strength.

B. Manufacturer: Greenlee “39243” or equal.

2.5 DUCT PLUGS

A. Provide rubber duct plugs that will produce a positive seal in unused ducts against water and gas. Plugs shall be made of soft, expansible rubber compressed with galvanized steel plates and bolts.

B. Provide plugs at each end of each conduit.

C. Manufacturer: Condux, Jackmoon USA, Inc.

2.6 UNDERGROUND DUCT MARKERS

A. Manufacturers:
   1. Brimar Pipemarker
   2. Seton
   3. Electromark,
   4. Utility Safeguard, LLC

B. Underground Warning Tape:
   1. Power: 3 inch wide minimum plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.
   2. Communication: 3 inch wide minimum plastic tape, detectable type, colored orange with suitable warning legend describing buried communication lines.

2.7 HANDHOLES

A. Manufacturers:
   1. Quazite or equal.

B. Description: Molded composite handholes and splice/pull boxes comprising modular, interlocking sections complete with accessories.

C. Enclosures, boxes and covers are required to conform to all test provisions of the most current ANSI/SCTE 77 “Specification for Underground Enclosure Integrity” for Tier 22 applications. When multiple “Tiers” are specified the boxes must physically accommodate and structurally support compatible covers while possessing the highest Tier rating. All covers are required to have the Tier level rating embossed on the surface. In no assembly can the cover design load exceed the design load of the box. All components in an assembly (box and cover) are manufactured using matched surface tooling. Independent third party verification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this specification have been met are required with each submittal.

D. Shape: Square, rectangular, as indicated on drawings.

E. Nominal Inside Dimensions: As indicated on drawings.

F. Inside Depth: As indicated on drawings.

G. Wall Thickness: As indicated on drawings.

H. Covers: Molded composite with stainless steel tamperproof fasteners. Furnish cover marked ELECTRIC and TELECOMMUNICATION to indicate utility.

I. Duct Entry Provisions: Single duct knockouts, window knockouts.

J. Duct Entry Locations: At each end and each side, as indicated on drawings or as required for conduit routing.

K. Duct Entry Size: To match conduit size.

L. All handholes and splice/pull boxes to have solid bottoms and gasketing.

2.8 MANHOLE AND SPLICE/PULL BOX LID AND FRAME

A. Material shall conform to ASTM A48 – Standard Specification for Gray Iron Castings, Class 35B.

B. Frame and lid shall be suitable for AASHTO HS-20 wheel loads.

C. Minimum clear opening through the frame will be 30 inches.

D. Furnish cover marked ELECTRIC.

E. Provide (1) frame and lid for each power manhole and splice/pull box.

F. Manufacturer: Neenah Foundry Company, Model R-1640-C1 or equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify routing and termination locations of conduits prior to excavation for rough-in.

B. Verify locations of manholes, splice/pull boxes, vaults, and handholes prior to excavating for installation.

C. Install underground conduit systems according to the NEC, the NESC, NECA/NEMA 600 – Standard Practices for installing Underground Nonmetallic Utility Duct, and the requirements in this Section.

D. Conduit system routing shown on Drawings is in approximate locations unless dimensioned. Route as required to complete the system.
   1. Coordinate underground conduit system work to avoid interference with other trades, existing utilities, new/future utilities, and new buildings and structures.
   2. Verify routing and termination locations of conduits before excavation for rough-in.
   3. Verify that field measurements are as shown on Drawings.

E. Position trench so conduits will have the following minimum horizontal and vertical separations from parallel or perpendicular runs other utility pipes or conduits.

UTILITY TYPE	PARALLEL LINES	PERPENDICULAR CROSSINGS
Water	36" horizontal separation	24"
Gravity Sewer	36" horizontal separation	24"
Force Main Sewer	36" horizontal separation	24"
Storm Drain	36" horizontal separation	24"
Natural Gas	60" horizontal separation	24"
Steam or Hot Water	60" horizontal separation	24"
Open Communications	24" horizontal separation of tamped soil or 3" of concrete	12" vertical separation of tamped soil or 3" of concrete
Electrical	12" horizontal separation of tamped soil or 3" of concrete	12" vertical separation of tamped soil or 3" of concrete

3.2 EXCAVATION AND BACKFILL

A. Make excavation for manholes, splice/pull boxes, vaults, and handholes to depth required and to provide solid bearing.

B. Grade trenches for underground conduits to a minimum of 4 inches per 100 ft. toward precast splice/pull boxes and manholes.

C. Keep excavation dry during installation of work.

D. Make trenches of sufficient width to receive work to be installed.

E. Backfill excavations for manholes, splice/pull boxes, vaults, and handholes in 6 inch layers; use soil excavated; remove roots, rocks and sharp objects. Provide coarse sand as required for additional backfill material.

F. Moisture condition backfill soil and compact in accordance with ASTM D 1557 to 95% of maximum density under paved areas and 90% of maximum density under unpaved areas.

G. Overfill excavations to allow for settlement.

3.3 INSTALLATION

A. Installation shall include delivery, unloading, setting in place, coring through walls or other structures where required. Installation shall be performed in accordance with applicable standards, codes, requirements and recommendations of National, State and Local authorities having jurisdiction, the N.E.C. and OSHA.

B. All equipment, etc., shall be firmly installed, plumb and square.

C. All conduits should be left clean, dry and free of debris or other obstructions.

D. At completion of manhole, splice/pull box, vault, handhole, and conduit installation, the interiors shall be left dry and clean of dirt, mortar, concrete, and other debris.

E. The top of installed manholes, splice/pull boxes and vaults shall be flush with the finished grade in the area. A minimum installation of a 6” collar with lid is required. Provide 6” and 12” grade ring riser castings as required to elevate cover flush with finished grade.

F. The manhole, and splice/pull box cover/lid shall be bolted/anchored to the top of the installed grade ring with ½” galvanized hardware.

G. All conduit entry into manholes, splice/pull boxes, vaults, and handholes shall be accomplished by way of core-boring holes thru the walls to enable a tight and proper seal around all conduits.

H. Make changes in direction of conduit runs using long sweep bends.

I. Support conduits with duct spacers.

J. Anchor conduits to bottom of trench using reinforcing steel and wire at intervals not exceeding 10 ft.

K. Test each conduit for blockage or deformation after backfilling.
   1. Use a flexible mandrel/scraper not less than 12 in. long with a diameter approximately 1/4 in. less than the inside diameter of the duct.
   2. Pull a mandrel behind a brush with stiff bristles.
   3. Replace any duct section found blocked or deformed.
   4. Place underground warning tape in backfill 12 inches below the surface.
   5. Install measuring and pulling tape in each duct. Leave not less than 48 inches of slack at each end of the tape. Secure each end of tape.

L. Install conduit with minimum slope of 4 inches per 100 feet (0.33 percent). Slope conduit toward precast manholes, vaults, and splice/pull boxes and away from building entrances.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Insert conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using adhesive as recommended by manufacturer.

P. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

Q. Install no more than equivalent of two 90-degree bends between pull points.

R. Install fittings to accommodate expansion and deflection.

S. Terminate conduit at precast manhole, vault, and splice/pull box entries using end bell.
   1. For conduits installed through holes cut by the contractor, pack opening with non-shrink grout. Feather the edge of the grout around each bell and conform to the curvature of the bell end. Remove sharp edges and projections and fill voids within 6 inches of bell ends.

T. Stagger conduit joints vertically in horizontal runs.

U. Securely anchor conduit to prevent movement during backfilling.

V. Provide suitable pull string in each empty conduit except sleeves and nipples.

W. Swab conduit. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Backfill trenches in accordance with Section 31 20 00.

3.4 INSTALLATION – HANDHOLE

A. Excavate for handhole installation in accordance with Section 31 23 16.

B. Install and seal precast sections in accordance with ASTM C891.

C. Install handholes plumb.

D. Backfill handhole excavation in accordance with Section 31 23 23.

E. HANDHOLES INSTALLED IN GRASS LANDSCAPE AREAS- The top of installed hand-holes (concrete envelope) shall be flush with the existing grade in the area. The grading from the edge of the concrete envelope shall be accomplished by fanning topsoil away from the concrete envelope at a 2” drop in grade over a 10 ft. radius of the lid itself.

F. HANDHOLES INSTALLED IN CONCRETE SIDEWALKS AND PAVED/ROADWAY AREAS- The top of installed hand-holes (concrete envelope) shall be flush with the existing grade in the area.

G. All Quazite hand-holes shall be installed per Quazite Field Applications Instruction Sheet, which defines an approximate 10” wide X 12” deep sloped concrete ring to be installed around the entire perimeter of the hand-hole itself, for additional support in the event of heavy loading from motor vehicles, tractors, mowers, and other similar equipment.

H. All hand-holes shall be installed as per all standard Strongwell Corp. Quazite Product Field Applications sheets.

I. All conduit entry into hand-holes shall be accomplished utilizing a Greenlee Hydraulic Knockout Punch Driver of appropriate size, or a Greenlee carbide-Grit hole-saw as per Quazite Field Applications Instruction Sheets for hand-holes. All conduits shall be terminated at hand-hole with Carlon box adapters on the interior and glued to a PVC bell end of the conduit on the exterior.

3.5 GROUNDING

A. Install 5/8” diameter x 8 feet copper clad steel ground rod in each manhole, vault, and splice/pull box prior to setting top. Provide ground ring as shown in the Drawings.

END OF SECTION

SECTION 33 71 73

ELECTRICAL UTILITY SERVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and applicable sections of Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements shall govern the work of this contract unless otherwise specified herein and all requirements shall be completely fulfilled to the satisfaction of the Engineer and Owner.

B. All specification sections of Division 07 – Thermal and Moisture Protection, Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning (HVAC), Division 25 – Direct Digital Control Systems for HVAC, Division 26 – Electrical, and drawings are made part of this contract and shall apply to all work described in this Section.

1.2 SUMMARY

A. Section includes arrangement with Utility Company for permanent electric service; payment of Utility Company charges for service; service provisions; and utility metering equipment.

B. All work shall be in accordance with the City of Dover Electric Department's Electrical Service Handbook.

C. All conduit shall be inspected by the City of Dover Engineering Department prior to backfilling.

D. The Contractor shall include in his bid and pay the City of Dover Extension Fee prior to starting work for the City's portion of the work.

Generally, the City of Dover scope of work is as follows:

- Furnish and Install metering cabinet.

E. The Extension Fee shall be submitted to:
City of Dover
Public Utilities Department
860 Buttner Place
Dover, DE 19984

F. Coordinate and schedule service work with City of Dover Electric Department.
City of Dover
Municipal Electric Department
Gary Lawson, Engineering Fieldman
302.242.8459

G. Electrical power for lighting and operation of construction power tools by all trades shall be provided by Contractor from local utility or Contractor's on site generator. Contractor shall

provide all safety devices, extension cords, and remote outlets as required by regulations and use. All outlets shall be GFCI type.

H. Temporary lighting and wiring shall be provided by the Contractor in accordance with OSHA regulations.

I. The temporary power shall have the capacity to run construction equipment such as welders and floor finishing equipment.

J. Contractor shall pay all utility fees for the temporary service.

K. The temporary electric service shall be metered.

1.3 REFERENCES

TBD

1.4 SYSTEM DESCRIPTION

A. Utility Company: City of Dover.

B. System Characteristics: 12,470 volts, three phase, 60 Hertz.

C. Underground Service Provisions: Underground service entrance to building service entrance equipment.
   1. Utility Raceway Connection: At Utility Company's pad-mounted metering cabinet.
   2. Utility Service-Entrance Conductor Connection: At Utility Company's pad-mounted metering cabinet.

1.5 SUBMITTALS

A. Submit Utility-Company-prepared drawings.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

B. Maintain one copy of each document on site.

1.7 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.8 COORDINATION

A. Coordinate with utility company, relocation of overhead or underground lines interfering with construction. Where power lines are to be relocated, bill utility costs, directly to Owner.

B. Contact utility company regarding charges related to service installation. Include utility charges in this contract.

C. Utility charges for service installation will be paid by the Contractor.

PART 2 PRODUCTS

2.1 UTILITY METERS

A. Furnished by Utility Company.

2.2 UTILITY METER BASE

A. Furnished by Utility Company and installed by the Contractor.

2.3 METERING TRANSFORMER CABINET

A. Furnished by Utility Company.

2.4 METERING CABINET PAD

A. Furnished and installed by the Contractor.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify service equipment is ready to be connected and energized.

3.2 INSTALLATION

A. Install service entrance conduits to building service entrance pad mount transformer.

END OF SECTION