

Brandywine School District  
 Brandywine High School Renovations Phase 2  
 General Construction Package  
 ABHA Project 1629

#### ADDENDUM NO. 1 ISSUED BY

ABHA Architects, Inc.  
 1621 N. Lincoln Street  
 Wilmington, Delaware 19806

NOTICE: Attach this Addendum to the Project Manual for this project. It modifies and becomes a part of the Contract documents. Work or materials not specifically mentioned herein are to be as described in the main body of the Specifications and as shown on the Drawings.

Acknowledge receipt of the Addendum in the space provided on the Bid Form. This Addendum is being transmitted to contractors who have received Contract Documents. If there are any problems with legibility or content, please contact ABHA Architects, Inc. (302) 658-6426.

#### ATTACHMENTS

##### Drawings:

G-001, G-002, S-102, S-202, A-001, A-100, A-101,1, A-101.2, A-101.3, A-101.5, A-102,1, A-102.2, A-101.3, A-102.4, A-103,1, A-103.2, A-103.3, A-104,1, A-104.2, A-104.3, A-104.4, A-105,1, A-105.2, A-105.3, A-105.4, A-110, A-111,1, A-111.2, A-111.3, A-111.5, A-112,1, A-112.2, A-112.3, A-112.4, A-113,1, A-113.2, A-113.3, A-114,1, A-114.2, A-114.3, A-114.4, A-115.1, A-115.2, A-115.3, A-115.4, A-201, A-202, A-301, A-302, A-401, A-402, A-403, A-405, A-406, A-501, A-502, A-503, A-504, A-505, A-506, A-507, A-510, A-511, A-512, A-513, A-514, A-601, I-001, I-111.1, I-111.2, I-111.3, I-111.5, I-112.2, I-112.3, I-112.4, FP-101.1, FP-101.2, FP-101.3, FP-102.1, FP-102.2, FP-102.3, FP-102.4, FP-111.1, FP-111.2, FP-111.3, FP-112.1, FP-112.2, FP-112.3, FP-112.4, FP-501, FP-601, P-101.1, P-101.2, P-101.3, P-111.1, P-111.2, P-111.3, P-113.1, P-601, M-001, M-101.1, M-102.1, M-102.2, M-102.3, M-102.3, M-102.4, M-103.1, M-103.2, M-103.3, M-103.3, M-103.4, M-111.1, M-112.1, M-112.2, M-112.3, M-112.3, M-112.4, M-113.1, M-113.2, M-113.3, M-113.3, M-113.4, M-501, M-502, M-601  
 E-101.1, E-101.2, E-101.3, E-102.2, E-102.3, E-102.4, E-103.1, E-103.2, E-103.3, E-103.4, E-111.1, E-111.2, E-111.3, E-112.1, E-112.2, E-112.3, E-112.4, E-113.1, E-113.2, E-113.3, E-113.4, E-113.5, E-114.3, E-601

##### Specifications:

Section 00 4113 – USER BID FORM

Section 02 4100 – DEMOLITION

Section 04 1000 – UNIT MASONRY

Section 04 7200 – CAST STONE MASONRY

Section 06 8000 – COMPOSITE FABRICATED WALL PANELS

Section 07 4233 – INTERIOR SOLID PHENOLIC DECORATIVE WALL PANELS

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Section 08 1114 – PREFINISHED STEEL DOOR FRAMES  
Section 08 1416 – FLUSH WOOD DOORS  
Section 08 5113 – ALUMINUM WINDOWS  
Section 08 7100 – DOOR HARDWARE  
Section 09 0561 - COMMON WORK RESULTS FOR FLOOR PREPARATION  
Section 09 2116 – GYPSUM BOARD ASSEMBLIES  
Section 09 3000 – TILING  
Section 09 5100 – ACOUSTICAL CEILINGS  
Section 09 6500 – RESILIENT FLOORING  
Section 09 6813 – TILE CARPETING  
Section 09 6816 – SHEET CARPETING  
Section 09 7200 – WALL COVERING  
Section 09 9123 – INTERIOR PAINTING  
Section 09 9300 – REFINISHING WOOD FLOORING  
Section 10 1101 – VISUAL DISPLAY BOARDS  
Section 10 2113.19 – PLASTIC TOILET COMPARTMENTS  
Section 10 2800 – TOILET, BATH, AND LAUNDRY ACCESSORIES  
Section 10 4400 – FIRE PROTECTION SPECIALTIES  
Section 12 2413 – WINDOW TREATMENTS – ROLLER SHADES  
Section 12 3400 – LAMINATE CLAD CASEWORK  
Section 12 3600 – COUNTERTOPS  
Section 21 0170 – FIRE SUPPRESSION SPRINKLER SYSTEMS  
Section 22 0000 – GENERAL PROVISIONS – PLUMBING/FIREPROTECTION  
Section 22 0010 – BASIC MATERIALS AND METHODS – PLUMBING  
Section 22 0030 – INSULATION & COVERING – PLUMBING  
Section 22 0110 – DRAINAGE SYSTEMS – PLUMBING  
Section 22 0120 – DOMESTIC WATER SYSTEMS – PLUMBING  
Section 22 0140 – FIXTURES – PLUMBING  
Section 22 0190 – TESTING – PLUMBING  
Section 22 0191 – BALANCING – PLUMBING  
Section 23 0200 – GENERAL PROVISIONS – HVAC  
Section 23 0010 – BASIC MATERIALS AND METHODS – HVAC  
Section 23 0215 – VALVES  
Section 23 0230 – INSULATION & COVERING – HVAC  
Section 23 0300 – VIBRATION & SOUND ISOLATION – HVAC  
Section 23 0600 – AIR DISTRIBUTION & ACCESSORIES – HVAC  
Section 23 0605 – FANS  
Section 23 0760 – AIR HANDLING EQUIPMENT  
Section 23 0900 – AUTOMATIC TEMPERATURE CONTROL  
Section 23 0950 – TESTING & BALANCING OF MECHANICAL SYSTEMS

Section 26 0000 – GENERAL PROVISIONS – ELECTRICAL  
Section 26 0055 – ELECTRICAL IDENTIFICATION  
Section 26 0110 – RACEWAYS  
Section 26 0120 – WIRES AND CABLES  
Section 26 0121 – WIRE CONNECTIONS AND DEVICES  
Section 26 0135 – ELECTRICAL BOXES & FITTINGS  
Section 26 0140 – WIRING DEVICES  
Section 26 0155 – MOTOR STARTERS  
Section 26 0170 – MOTOR AND CIRCUIT DISCONNECTS  
Section 26 0180 – OVERCURRENT PROTECTIVE DEVICES  
Section 26 0190 – SUPPORTING DEVICES  
Section 26 0460 – TRANSFORMERS  
Section 26 0470 – DISTRIBUTION CIRCUITS  
Section 26 0471 – FEEDER CIRCUITS  
Section 26 0472 – BRANCH CIRCUITS  
Section 26 0510 – BUILDING LIGHTING

CHANGES TO PROJECT MANUAL:

Replace existing Section to the project manual with attached:

Section 00 4113 – BID FORM

Add the following Sections to the project manual:

Section 02 4100 – DEMOLITION  
Section 04 1000 – UNIT MASONRY  
Section 04 7200 – CAST STONE MASONRY  
Section 06 8000 – COMPOSITE FABRICATED WALL PANELS  
Section 07 4233 – INTERIOR SOLID PHENOLIC DECORATIVE WALL PANELS  
Section 08 1114 – PREFINISHED STEEL DOOR FRAMES  
Section 08 1416 – FLUSH WOOD DOORS  
Section 08 5113 – ALUMINUM WINDOWS  
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Section 09 0561 - COMMON WORK RESULTS FOR FLOOR PRPARATION  
Section 09 2116 – GYPSUM BOARD ASSEMBLIES  
Section 09 3000 – TILING  
Section 09 5100 – ACOUSTICAL CEILINGS  
Section 09 6500 – RESILIENT FLOORING  
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Section 22 0030 – INSULATION & COVERING – PLUMBING  
Section 22 0110 – DRAINAGE SYSTEMS – PLUMBING  
Section 22 0120 – DOMESTIC WATER SYSTEMS – PLUMBING  
Section 22 0140 – FIXTURES – PLUMBING  
Section 22 0190 – TESTING – PLUMBING  
Section 22 0191 – BALANCING – PLUMBING  
Section 23 0200 – GENERAL PROVISIONS – HVAC  
Section 23 0010 – BASIC MATERIALS AND METHODS – HVAC  
Section 23 0215 – VALVES  
Section 23 0230 – INSULATION & COVERING – HVAC  
Section 23 0300 – VIBRATION & SOUND ISOLATION – HVAC  
Section 23 0600 – AIR DISTRIBUION & ACCESSORIES – HVAC  
Section 23 0605 – FANS  
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Section 26 0170 – MOTOR AND CIRCUIT DISCONNECTS  
Section 26 0180 – OVERCURRENT PROTECTIVE DEVICES  
Section 26 0190 – SUPPORTING DEVICES  
Section 26 0460 – TRANSFORMERS  
Section 26 0470 – DISTRIBUTION CIRCUITS  
Section 26 0471 – FEEDER CIRCUITS  
Section 26 0472 – BRANCH CIRCUITS  
Section 26 0510 – BUILDING LIGHTING

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ADDENDUM NO. 1  
April 24, 2019  
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CHANGES TO DRAWINGS

Replace ENTIRE drawing package with attached  
Changes to Drawings have been bubbled

END OF ADDENDUM NO. 1

**SECTION 00 4113**  
**BID FORM**

FOR BIDS DUE: \_\_\_\_\_

TO: FOR: BRANDYWINE SCHOOL DISTRICT  
BRANDYWINE HIGH SCHOOL  
PHASE 2 - GENERAL CONSTRUCTION  
PACKAGE

FOR CONTRACT:  
NAME OF BIDDER: \_\_\_\_\_  
DELAWARE BUSINESS LICENSE NO.: \_\_\_\_\_  
(A copy of Bidder's Delaware Business License must be attached to this form.)  
TAXPAYER ID NO.: \_\_\_\_\_  
(OTHER LICENSE NOS.): \_\_\_\_\_  
PHONE NO.: (     ) \_\_\_\_\_ FAX NO.: (     ) \_\_\_\_\_  
EMAIL ADDRESS: \_\_\_\_\_

The undersigned, representing that he has read and understands the Bidding Documents, including the complete Project Manual and the Drawings as listed in the Table of Contents, all dated April 8, 2019, 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:

BASE BID AREA A (AUDITORIUM WING):

\_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_)  
(expressed in figures)

**BID FORM**

ALTERNATES

Alternate prices conform to applicable project specification section. Refer to specifications for a complete description of the following Alternates. An “ADD” or “DEDUCT” amount is indicated by the crossed out part that does not apply.

ALTERNATE NO. 1: WINDOW REPLACEMENT

Add/Deduct: \_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_ )  
(expressed in figures)

ALTERNATE NO. 1A: WINDOWS IN AREA C & E - 1ST FLOOR

Add/Deduct: \_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_ )  
(expressed in figures)

ALTERNATE NO. 1B: WINDOWS IN AREA E - 1ST FLOOR

Add/Deduct: \_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_ )  
(expressed in figures)

ALTERNATE NO. 1C: WINDOWS IN AREA C - 2ND FLOOR

Add/Deduct: \_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_ )  
(expressed in figures)

ALTERNATE NO. 1 TOTAL: \$ \_\_\_\_\_

ALTERNATE NO. 2: AREA B FIRST FLOOR: OFFICES B105, TOILET ROOM ADDITION B103A & B103B, DOORS ALONG CORRIDOR CR101

Add/Deduct: \_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_ )  
(expressed in figures)

ALTERNATE NO. 2: AREA C FIRST FLOOR: TOILET ROOM RENOVATIONS C109 & C111, MECH. C110, JAN 109A & AREA C SECOND FLOOR: TOILET ROOM RENOVATIONS C207 & C203, MECH C205, JAN 206

Add/Deduct: \_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_ )

(expressed in figures)

ALTERNATE NO. 2A: AREA B FIRST FLOOR: ADDITION OF OFFICE B105A AND REVISION OF OFFICE B107

Add/Deduct: \_\_\_\_\_

(expressed in words)

(\$ \_\_\_\_\_ )

(expressed in figures)

ALTERNATE NO. 3: AREA B SECOND FLOOR: CLASSROOM ENTRANCES AND FINISH, DOORS ALONG CORRIDOR CR201

Add/Deduct: \_\_\_\_\_

(expressed in words)

(\$ \_\_\_\_\_ )

(expressed in figures)

ALTERNATE NO. 3A: AREA B SECOND FLOOR: CORRIDOR CR201 FLOOR AND CEILING FINISHES AND LIGHTING

Add/Deduct: \_\_\_\_\_

(expressed in words)

(\$ \_\_\_\_\_ )

(expressed in figures)

ALTERNATE NO. 4: AREA C SECOND FLOOR: LIBRARY SUITE AND INTERIOR FINISH OF CORRIDOR CR202 WALLS

Add/Deduct: \_\_\_\_\_

(expressed in words)

(\$ \_\_\_\_\_ )

(expressed in figures)

ALTERNATE NO. 4A: AREA C SECOND FLOOR: CORRIDOR CR202 FLOOR AND CEILING FINISHES AND LIGHTING

Add/Deduct: \_\_\_\_\_

(expressed in words)

(\$ \_\_\_\_\_ )

(expressed in figures)

ALTERNATE NO. 5: AREA C SECOND FLOOR: CLASSROOM ALONG CORRIDOR CR203

Add/Deduct: \_\_\_\_\_

(expressed in words)

(\$ \_\_\_\_\_ )

(expressed in figures)

ALTERNATE NO. 5A: AREA C SECOND FLOOR: CORRIDOR CR203 FLOOR AND CEILING FINISHES AND LIGHTING

Add/Deduct: \_\_\_\_\_

(expressed in words)

(\$ \_\_\_\_\_ )  
(expressed in figures)

ALTERNATE NO. 6: AREA D SECOND FLOOR: CLASSROOMS ALONG CORRIDOR  
CR204 AND CR205

Add/Deduct: \_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_ )  
(expressed in figures)

ALTERNATE NO. 6A: AREA D SECOND FLOOR: CORRIDOR CR204 AND CR205 FLOOR  
AND CEILING FINISHES AND LIGHTING

Add/Deduct: \_\_\_\_\_  
(expressed in words)

(\$ \_\_\_\_\_ )  
(expressed in figures)

UNIT PRICE NO. 1: XXX

Price per xxx  
Add: \_\_\_\_\_  
Deduct: \_\_\_\_\_

UNIT PRICE NO. 2: XXX

Price per xxx  
Add: \_\_\_\_\_  
Deduct: \_\_\_\_\_

**BID FORM**

SIGNATURE FORM

I / We acknowledge Addendas Numbered \_\_\_\_\_ and the price(s)  
submitted include any cost / schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for 30 days from the date of opening of  
bids (60 days for School Districts and Department of Education), and the undersigned shall  
abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid.

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.

Should I/We be awarded this contract, I/We pledge to achieve substantial completion of all the  
work within \_\_\_\_\_ calendar days of the Notice to Proceed.

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.

Affidavit(s) of Employee Drug Testing Program

Bid Security.

**BID FORM**  
**SUBCONTRACTOR LIST**

SUBCONTRACTOR CATEGORY	SUBCONTRACTOR	ADDRESS (City & State)	SUBCONTRACTOR Taxpayer ID # or DE Business License #
Concrete			
Masonry			
Misc. Steel			
Carpentry			
Windows			
Doors and Hardware			
Glazing			
Gypsumboard & Metal Framing			
Flooring			
Ceramic Tile			
Phenolic Panels			
Painting			
Wallcovering			
Acoustical Ceilings			
White/Tackboards			
Toilet Partitions & Accessories			
Window Treatment			
Casework/Display Cases			
Fire Protection			

Plumbing			
Mechanical			
Electrical			

**BID FORM**  
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 *(to the Office of Management and Budget, Division of Facilities Management)*.

All the terms and conditions of this Contract have been thoroughly examined and are understood.

NAME OF BIDDER: \_\_\_\_\_

AUTHORIZED REPRESENTATIVE  
(TYPED): \_\_\_\_\_

AUTHORIZED REPRESENTATIVE  
(SIGNATURE): \_\_\_\_\_

TITLE: \_\_\_\_\_

ADDRESS OF BIDDER: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHONE NUMBER: \_\_\_\_\_

EMAIL: \_\_\_\_\_

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 FORM**  
**EMPLOYEE DRUG TESTING PROGRAM**

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors implement a program of mandatory drug testing for Employees who work on Large Public Works Contracts funded all or in part with public funds.

We hereby certify that we have in place or will implement during the entire term of the contract a Mandatory Drug Testing Program for our employees on the jobsite that complies with this regulation:

CONTRACTOR/SUBCONTRACTOR

NAME: \_\_\_\_\_

CONTRACTOR/SUBCONTRACTOR

ADDRESS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

AUTHORIZED REPRESENTATIVE

(TYPED): \_\_\_\_\_

AUTHORIZED REPRESENTATIVE

(SIGNATURE): \_\_\_\_\_

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.**

**END OF SECTION**

**SECTION 02 4100**  
**DEMOLITION**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
  - 1. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

**PART 2 PRODUCTS**

**PART 3 EXECUTION**

3.01 SCOPE

- A. Remove other items indicated, for salvage, relocation, recycling, and turnover to owner.
- B. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2200.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.

5. Do not close or obstruct roadways or sidewalks without permit.
  6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
  7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
  2. Prevent movement or settlement of adjacent structures.
  3. Stop work immediately if adjacent structures appear to be in danger.

### 3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as indicated.
  2. Report discrepancies to Architect before disturbing existing installation.
  3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- C. Remove existing work as indicated and as required to accomplish new work.
1. Remove items indicated on drawings.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
  2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
  3. Verify that abandoned services serve only abandoned facilities before removal.
  4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
  2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  3. Repair adjacent construction and finishes damaged during removal work.
  4. Patch as specified for patching new work.

### 3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

**SECTION 04 2000**  
**UNIT MASONRY**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Concrete Block.
- B. Clay facing brick.
- C. Mortar and Grout.
- D. Reinforcement and Anchorage.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2016.
- C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
- E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- F. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2017.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- 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); 2017a.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- L. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
- M. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 MOCK-UP

- A. Locate where directed.
- B. Mock-up may remain as part of the Work.

1.06 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. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm).
  - 2. Special Shapes: Provide non-standard blocks configured for corners.
  - 3. Load-Bearing Units: ASTM C90, normal weight.

2.02 BRICK UNITS

- A. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
  - 1. Color and texture: MATCH EXISTING.
  - 2. Nominal size: MATCH EXISTING.

2.03 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
  - 1. Not more than 0.60 percent alkali.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
  - 1. Color(s): As selected by Architect from manufacturer's full range.
- F. Water: Clean and potable.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- B. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.
- C. Multiple Wythe Joint Reinforcement: Truss type; fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.

## 2.05 FLASHINGS

- A. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M stainless steel sheet bonded with rubber-based adhesive between one sheet of polymer fabric and one sheet of non-woven drainage material, with manufacturer's standard, self adhering, stainless steel lap tape.
  - 1. Manufacturers:
    - a. York Manufacturing, Inc; Flash-Vent SS: [www.yorkmfg.com/#sle](http://www.yorkmfg.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.

## 2.06 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 S.
  - 2. 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 (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

## 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 COLD AND HOT WEATHER REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

### 3.03 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
- D. Brick Units:

### 3.04 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 REINFORCEMENT AND ANCHORAGE - GENERAL

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

3.06 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Lap joint reinforcement ends minimum 6 inches (150 mm).
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.

3.07 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 metal flashings to within 1/4 inch (6 mm) of exterior face of masonry.

3.08 BUILT-IN WORK

- A. As work progresses, install built-in electrical boxes, conduits, 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.

3.09 TOLERANCES

- A. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- B. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- C. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- D. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

3.10 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.

**END OF SECTION**

**SECTION 04 7200**  
**CAST STONE MASONRY**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Architectural cast stone.
- B. Units required are indicated on drawings as "cast stone".
- C. Units required are:
  - 1. Window sills.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.
- B. Section 07 9200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2017).
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.
- C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2016.
- D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2017.
- J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Test results of cast stone components made previously by the manufacturer.
- C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- D. Verification Samples: Pieces of actual cast stone components not less than 6 inches (152 mm) square, illustrating range of color and texture to be anticipated in components furnished for the project.
- E. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:

1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
2. Current producer member of the Cast Stone Institute or the Architectural Precast Association.
3. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

#### 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 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 (6 meters).
  4. Color: Selected by Architect from manufacturer's full range.
  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 (3 mm) or length divided by 360, whichever is greater, but not more than 1/4 inch (6 mm).
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

#### 2.02 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
  1. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Admixtures: ASTM C494/C494M.

- E. Water: Potable.
- F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
  - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, 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, as specified in Section 04 0511; 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 EXAMINATION**

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

#### **3.02 INSTALLATION**

- A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.
- B. Mechanically anchor each cast stone unit.
- 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 (9.5 mm), except as otherwise detailed.
  - 1. Rake mortar joints 3/4 inch (19 mm) for pointing.
  - 2. Remove excess mortar from face of stone before pointing joints.
  - 3. Point joints with mortar in layers 3/8 inch (9.5 mm) thick and tool to a slight concave profile.
  - 4. Leave the following joints open for sealant:
    - a. Head Joints in wall caps.
- E. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet (6 m).
  - 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.

#### **3.03 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.

#### 3.04 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 09 5100**  
**ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Accessories

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Acoustical sealant.
- B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.
- C. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- D. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.
- E. Section 27 5116 - Public Address Systems: Speakers in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- 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; 2014.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.04 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.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components, acoustical units, and other related components.
- C. Samples: Submit two samples 12 x 12 inch (305 x 305 mm) or of size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 6 inches (\_\_\_\_ mm) long, of suspension system main runner, cross runner, perimeter molding, and related sections.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

### 1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

### 1.08 PROJECT CONDITIONS

- 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. Install acoustical units after interior wet work is dry.

## **PART 2 PRODUCTS**

### 2.01 MANUFACTURERS

### 2.02 ACOUSTICAL UNITS

- A. Manufacturers:
  - 1. Basis of Design: Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2. Certainteed BPB Celotex: [www.certainteed.com](http://www.certainteed.com).
  - 3. USG: [www.usg.com](http://www.usg.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Acoustical Units - General: ASTM E1264, Class A.
- C. Acoustical Tile Type 1: Painted faced mineral fiber, ASTM E1264 Type IV, Form 2, Pattern E, Fire Class A with the following characteristics:
  - 1. Size: 24 by 24 inches (\_\_\_ by \_\_\_ mm).
  - 2. Thickness: 7/8 inches (\_\_\_ mm).
  - 3. Composition: Water felted.
  - 4. Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
  - 5. NRC Range: .85 to .85, determined in accordance with ASTM E1264.
  - 6. Articulation Class (AC): 170, determined in accordance with ASTM E1264.
  - 7. Ceiling Attenuation Class (CAC): 32, determined in accordance with ASTM E1264.
  - 8. Edge: Square.
  - 9. Surface Color: White.
  - 10. Surface Pattern: Smooth.
  - 11. Suspension System: Exposed grid Type 1.
  - 12. Products:
    - a. Calla, Item No 2824, manufactured by Armstrong World Industries.
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Acoustical Panels Type 2A: Painted mineral fiber, ASTM E 1264 Type 1 with the following characteristics:
  - 1. Size: 24 by 24 inches (600 by 600 mm).
  - 2. Thickness: 3/4 inches (19 mm).
  - 3. Composition: Wet formed.
  - 4. NRC Range: .50 to .60, determined in accordance with ASTM E1264.
  - 5. Ceiling Attenuation Class (CAC): 33, determined in accordance with ASTM E1264.
  - 6. Edge: Square.
  - 7. Surface Color: White.
  - 8. Surface Pattern: course texture.
  - 9. Product:
    - a. Substitutions: See Section 01 6000 - Product Requirements.

- b. Basis of Specification: Armstrong Tundra Item No. 303
- c. USG : Rockface Climaplus Item No.55483
- 10. Suspension System: Exposed grid Type 2 .
- 11. Location: Toilet Rooms, and as noted.

### 2.03 SUSPENSION SYSTEM(S) AND PERIMETER TRIM

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- B. Exposed Steel Suspension System Type 1: Formed galvanized steel, commercial quality cold rolled; intermediate-duty.
  - 1. Profile: Tee; 15/16 inch (24 mm) wide face.
  - 2. Construction: Double web.
  - 3. Finish: White painted.
  - 4. Product: Prelude XL by Armstrong; DX by USG
- C. Exposed Steel Suspension System Type 2 (for Acoustical Panel Ceiling TYPE-2B, 3): Where this designation is indicated, provide acoustical panel ceiling suspension system complying with the following:
  - 1. Products:
    - a. ZXLA; USG
    - b. Prelude Plus; Armstrong
  - 2. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized-Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with pre-finished, 15/16-inch-(24-mm-) wide, aluminum caps on flanges; other characteristics as follows:
    - a. Aluminum Cap Finish: Painted white.

### 2.04 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.
  - 2. At Concealed Grid: Provide exposed L-shaped molding.
- C. Acoustical Insulation: Specified in Section 07 2100.
  - 1. Thickness: 2 inch (50 mm).
  - 2. Size: To fit acoustical suspension system.
- D. Gypsum Board: Fire rated type; 5/8 inch (15 mm) thick, ends and edges square, paper faced.
- E. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 9005.
- F. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
  - 1. Products:
  - 2. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following requirements:

- a. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
3. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Acoustical Sealant for Exposed and Concealed Joints:
    - 1) PL Acoustical Sealant; Chemrex, Inc., Contech Brands.
    - 2) AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
    - 3) SHEETROCK Acoustical Sealant; United States Gypsum Co.
  - G. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.
  - H. Touch-up Paint: Type and color to match acoustical and grid units.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

#### **3.02 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. Locate system on room axis according to reflected ceiling plans.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. 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.
- F. 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.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  1. Install in bed of acoustical sealant or with continuous gasket.
  2. Use longest practical lengths.
  3. Miter corners.
- K. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a

- tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- L. Form expansion joints . Form to accommodate plus or minus 1 inch (25 mm) movement. Maintain visual closure.
- M. Install light fixture boxes constructed of gypsum board or acoustical panel above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.
- N. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
  3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
  6. Do not attach hangers to steel deck tabs.
  7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.
- O. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- P. Install special brake-metal shapes at window heads so that they are square and finished to provide a precise fit. Do not use exposed fasteners.
- Q. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  3. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.

### 3.03 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. Lay directional patterned units with pattern parallel to longest room axis.
- D. Fit border trim neatly against abutting surfaces.
- E. Install units after above-ceiling work is complete.
- F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- G. Cutting Acoustical Units:
  - 1. Cut to fit irregular grid and perimeter edge trim.
  - 2. Make field cut edges of same profile as factory edges.
  - 3. Double cut and field paint exposed reveal edges.
- H. Where round obstructions, bullnose concrete block corners, and other similar conditions occur, provide preformed closures to match perimeter molding.
- I. Lay acoustical insulation for a distance of 48 inches (1200 mm) either side of acoustical partitions as indicated.
- J. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.
- K. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

### 3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**END OF SECTION**

**SECTION 09 6500**  
**RESILIENT FLOORING**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Luxury Vinyl Tile
- C. Resilient base.
- D. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, 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; 2014c.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- C. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2015.
- D. ASTM F1700 - Standard Specification for Solid Vinyl Tile; 2013a.
- E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- B. Shop Drawings: Indicate seaming plans and floor patterns.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, 6 by 6 inch (\_\_\_ by \_\_\_ mm) in size illustrating color and pattern for each resilient flooring product specified.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Flooring Material: 100 square feet (\_\_\_\_ square meters) of each type and color.
  - 2. Extra Wall Base: 50 linear feet (\_\_\_\_ linear meters) of each type and color.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.

- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

#### 1.06 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

### **PART 2 PRODUCTS**

#### 2.01 TILE FLOORING

- A. Luxury Vinyl Tile (LVT-1): Printed film type, with transparent or translucent wear layer.
  - 1. Manufacturers:
    - a. Mannington Commercial; Spacia-Wood: [www.manningtoncommercial.com](http://www.manningtoncommercial.com).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
  - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
  - 4. Plank Tile Size: 4 by 36 inch (102 by 914 mm).
  - 5. Wear Layer Thickness: 0.020 inch (0.50 mm).
  - 6. Total Thickness: 0.095 inch (0.51 mm).
  - 7. Color: As indicated on drawings.
- B. Rubber Tile: Type RT-1, RT-2, RT-3, RT-4, RT-5, Type I- Homogeneous, color and pattern throughout thickness;
  - 1. Manufacturers:
    - a. Basis of Design: Nora Systems, Inc.; noraplan environcare: [www.nora.com](http://www.nora.com)
    - b. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
  - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
  - 4. Size: 24 by 24 inch (610 by 610 mm).
  - 5. Total Thickness: 0.12 inch (3.0 mm) (3.0 mm).
  - 6. Color: As indicated on drawings.

#### 2.02 RESILIENT BASE

- A. Resilient Base Type RB-1, RB-2, RB-3, RB-4, RB-5: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
  - 1. Manufacturers:
    - a. Basis of Design: Johnsonite, a Tarkett Company: [www.johnsonite.com](http://www.johnsonite.com).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Height: 4 inch (100 mm) (typical, unless otherwise noted).
  - 3. Thickness: 0.125 inch (3.2 mm).
  - 4. Finish: Satin.
  - 5. Color: As indicated on drawings.

### 2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: Same material as flooring.

## **PART 3 EXECUTION**

### 3.01 EXAMINATION

- A. 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 flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
  - 1. Test in accordance with Section 09 0561.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

### 3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

### 3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints and butt seams tightly.
- E. Set flooring in place, press with heavy roller to attain full adhesion.
- F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- I. Install flooring in recessed floor access covers and expansion joint covers, maintaining floor pattern.
- J. At movable partitions, install flooring under partitions without interrupting floor pattern.

### 3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install plank tile with a random offset of at least 6 inches (152 mm) from adjacent rows.

### 3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter or scribe internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.

### 3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

**END OF SECTION**

**SECTION 09 6813**  
**TILE CARPETING**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.
- B. Walk-off carpet tile, tab applied

1.02 RELATED REQUIREMENTS

- A. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
- C. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2011.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - 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. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

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 tile with minimum three years documented experience and approved by carpet tile manufacturer.

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. Tile Carpeting, Type CPT-1: Tufted, multi-level pattern loop, manufactured in one color dye lot.

1. Product: Diffuse manufactured by Shaw Contract.
  2. Tile Size:   24   by   24   inch (       by        mm), nominal.
  3. Thickness: .230 inch (       mm).
  4. Dye method: 100% solution dyed.
  5. Color: as indicated on drawings.
  6. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
  7. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  8. Gage: 1/12 inch (       mm).
  9. Stitches: 9 per inch (       per cm).
  10. Primary Backing Material: Synthetic.
  11. Secondary Backing Material: Ecoworx Tile.
  12. Installation Method: Ashlar, fully adhered.
- B. Carpet Tile Type WOC-1: Tufted, tip sheared loop, manufactured in one color dye lot.
1. Product: Traverse manufactured by Mannington Commercial.
  2. Tile Size: 24 x 24 inch (610 x 610 mm), nominal.
  3. Thickness:        inch ( mm).
  4. Dye method: 100% solution/yarn dyed.
  5. Color: as indicated on drawings.
  6. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E 648 or NFPA 253.
  7. Surface Flammability Ignition: Pass ASTM D 2859 (the "pill test").
  8. VOC Content: Comply with Section 01 6116.
  9. Gage: 5/32 inch (       mm).
  10. Stitches: 9 per inch (       per cm).
  11. Primary Backing Material: Synthetic.
  12. Secondary Backing Material: Non-aqueous closed cell polymer.
  13. Installation: Quarter Turned, Freelock Tab System

## 2.02 ACCESSORIES

- A. Sub-Floor Filler: See Section 09 0561 - Common Work Results for Flooring Preparation.
- B. Edge Strips: Rubber, color as selected by architect.
- C. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC content as specified in Section 01 6116.

## 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 wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

### 3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.

### 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, with pile direction alternating to next unit, set parallel to building lines, unless otherwise indicated.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. 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 6816**  
**SHEET CARPETING**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Carpet, direct-glued.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).
- B. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- C. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

1.04 SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- B. Samples: Submit two samples 12 by 12 inch (\_\_\_\_by\_\_\_\_ mm) in size illustrating color and pattern for each carpet and cushion material specified.
- C. Manufacturer's Installation Instructions: Indicate special procedures.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional requirements.
  - 2. Extra Carpet: 50 square feet of each type, color, and pattern installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature 24 hours prior to, during and 24 hours after installation.
- C. Ventilate installation area during installation and for 72 hours after installation.

**PART 2 PRODUCTS**

2.01 CARPET

- A. Carpet, Type BC-1:
  - 1. Product: Escape manufactured by Shaw Contract.
  - 2. Roll Width: 12 ft ( mm).
  - 3. Color: as scheduled.

4. Dye Method: 100% solution dyed.
5. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 ACCESSORIES

- A. Sub-Floor Filler: See Section 09 0561 - Common Work Results for Flooring Preparation.
- B. Edge Strips: Rubber, color as selected by architect.
- C. Seam Adhesive: Compatible with carpet material, as recommended by manufacturer.
- D. Contact Adhesive: Compatible with carpet material, as recommended by 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 carpet.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.
- D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).
  1. Test in accordance with Section 09 0561.
  2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### 3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561 and as recommended by manufacturer.

### 3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Lay out carpet and locate seams in accordance with shop drawings.
  1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
  2. Do not locate seams perpendicular through door openings.
  3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
  4. Locate change of color or pattern between rooms under door centerline.
  5. Provide monolithic color, pattern, and texture match within any one area.
- E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

### 3.04 DIRECT-GLUED CARPET

- A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.
- B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

- C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
- D. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- E. Trim carpet neatly at walls and around interruptions.
- F. Extend carpet as base finish up vertical surfaces to form base. Terminate top of base with cap strip.
- G. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

### 3.05 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

**END OF SECTION**

**SECTION 09 7200**  
**WALL COVERINGS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Wall covering and borders.

1.02 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit two samples of wall covering, 6 by 6 inch (     by      mm) in size illustrating color, finish, and texture.
- E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

**PART 2 PRODUCTS**

2.01 WALL COVERINGS

- A. Wall Covering - Type WC-1: Fabric-backed vinyl roll stock.
  - 1. Conform to ASTM F793, Category V, Type II.
  - 2. Total Weight: 20 oz/sq yd (     g/sq m).

3. Roll Width: 54 inches (\_\_\_\_\_ mm).
4. Pattern: Custom.
5. Surface Texture: Mystical.
6. Manufacturers:
  - a. Basis of Design: Eykon Creative Digital Wallcovering on Mystical Substrate.
  - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall Covering - Type WP-1:
  1. Content: 100% Vinyl
  2. Backing: Dense Polyester/Cotton
  3. Finish: Spill and stain resistant treatment
  4. Width: 52"
  5. Weight: 35 oz per linear yard
  6. Hanging Information: Reverse Hang, Random Match
  7. Material
    - a. RAMPART Wall Protection as manufactured by Wolf Gordon
- C. Adhesive: Type recommended by wallcovering manufacturer to suit application to substrate.
- D. Termination Trim: Aluminum top cap by Inpro, brushed aluminum color.
- E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- F. Substrate Primer and Sealer: Alkyd enamel type.
- G. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- H. Substrate Primer and Sealer: Alkyd enamel type.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

#### **3.02 PREPARATION**

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- E. Vacuum clean surfaces free of loose particles.

#### **3.03 INSTALLATION**

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering. Let contact adhesive set tack free.

- C. Use wall covering in roll number sequence.
- D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
- E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- F. Butt edges tightly.
- G. Horizontal seams are not acceptable.
- H. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.
- I. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- J. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.
- K. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- L. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches (150 mm) of wall covering termination. Ensure full contact bond.
- M. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

#### 3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this section.

#### 3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

**END OF SECTION**

**SECTION 09 7200**  
**WALL COVERINGS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Wall covering and borders.

1.02 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit two samples of wall covering, 6 by 6 inch (     by      mm) in size illustrating color, finish, and texture.
- E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

**PART 2 PRODUCTS**

2.01 WALL COVERINGS

- A. Wall Covering - Type WC-1: Fabric-backed vinyl roll stock.
  - 1. Conform to ASTM F793, Category V, Type II.
  - 2. Total Weight: 20 oz/sq yd (     g/sq m).

3. Roll Width: 54 inches (\_\_\_\_\_ mm).
4. Pattern: Custom.
5. Surface Texture: Mystical.
6. Manufacturers:
  - a. Basis of Design: Eykon Creative Digital Wallcovering on Mystical Substrate.
  - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall Covering - Type WP-1:
  1. Content: 100% Vinyl
  2. Backing: Dense Polyester/Cotton
  3. Finish: Spill and stain resistant treatment
  4. Width: 52"
  5. Weight: 35 oz per linear yard
  6. Hanging Information: Reverse Hang, Random Match
  7. Material
    - a. RAMPART Wall Protection as manufactured by Wolf Gordon
- C. Adhesive: Type recommended by wallcovering manufacturer to suit application to substrate.
- D. Termination Trim: Aluminum top cap by Inpro, brushed aluminum color.
- E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- F. Substrate Primer and Sealer: Alkyd enamel type.
- G. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- H. Substrate Primer and Sealer: Alkyd enamel type.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

#### **3.02 PREPARATION**

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- E. Vacuum clean surfaces free of loose particles.

#### **3.03 INSTALLATION**

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering. Let contact adhesive set tack free.

- C. Use wall covering in roll number sequence.
- D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
- E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- F. Butt edges tightly.
- G. Horizontal seams are not acceptable.
- H. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.
- I. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- J. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.
- K. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- L. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches (150 mm) of wall covering termination. Ensure full contact bond.
- M. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

#### 3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this section.

#### 3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

**END OF SECTION**

**SECTION 09 9300**  
**REFINISHING WOOD FLOORING**

**PART 1 GENERAL**

1.01 RELATED DOCUMENTS

- A. 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.

1.02 SECTION INCLUDES

- A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01011, 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. Sanding and refinishing of solid-wood strip or plank flooring.

1.03 SUBMITTALS

- A. Product Data: Submit for each product to be used. Include fillers and primers.
  - 1. Material List: Provide an inclusive list of required materials. Indicate each material and cross-reference specific finish system and application.
  - 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
  - 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed wood flooring similar in material, design, and extent to that indicated for this Project and whose work has resulted in wood flooring installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of material and product from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- C. Sample Room: Request review of first finished room for color, appearance, and workmanship. Approved room shall serve as the standard of quality for the project.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.
  - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

- C. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

#### 1.06 PROJECT CONDITIONS

- A. Conditioning: Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75 deg F in spaces to receive wood flooring for at least seven days before re-finishing. After re-finishing, maintain relative humidity and ambient temperature planned for building occupants.
  - 1. Close spaces to traffic during flooring re-finishing and for time period after re-finishing recommended in writing by finish manufacturers.
- B. Apply water-based finishes only when the temperature of surfaces to be finished and surrounding air temperatures are between 50 and 90 deg F.
- C. Apply solvent-thinned finishes only when the temperature of surfaces to be finished and surrounding air temperatures are between 45 and 95 deg F.

### **PART 2 PRODUCTS**

#### 2.01 FINISHING MATERIALS

- A. Urethane Finish System: Complete system of compatible components that is recommended by finish manufacturer for application indicated.
  - 1. Type: Solvent based, oil modified, or water based may be used.
  - 2. Stain: Penetrating and non fading type.
  - 3. Color: As selected by Architect from manufacturer's full range.
  - 4. Floor Sealer: Pliable, penetrating type.
  - 5. Finish Coats: Formulated for multi coat application on wood flooring.
- B. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Basic Coatings.
  - 2. BonaKemi USA, Inc.
  - 3. Dura Seal Division; Minwax Co., Inc.
  - 4. Hillyard Floor Treatments.
  - 5. Huntington Laboratories, Inc.
  - 6. National Coatings Co.
- C. Wood Filler: Formulated to fill and repair seams, defects, and open-grain hardwood floors; compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved samples, provide pigmented filler.

### **PART 3 EXECUTION**

#### 3.01 EXAMINATION

- A. Examine wood flooring areas and condition for compliance with requirements, tolerances, and other conditions affecting performance of wood flooring. Proceed with re-finishing only after unsatisfactory conditions have been corrected.

#### 3.02 SANDING AND FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

- B. Apply filler according to manufacturer's written instructions. Fill open-grained hardwood. Fill and repair seams and defects.
- C. Apply stain to match approved sample if required.
- D. Apply floor sealer according to finish manufacturer's written instructions.
- E. Apply floor finish according to finish manufacturer's written instructions. Apply in number of coats recommended by finish manufacturer for application indicated, but not less than the number of coats indicated on drawings and schedule at the end of this Section.
- F. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

### 3.03 PROTECTION

- A. Cover installed wood flooring to protect it from damage or deterioration, before and after finishing, during remainder of construction period. Use heavy Kraft-paper or other suitable covering. Do not use plastic sheet or film that could cause condensation.
  - 1. Do not cover site-finished floors with Kraft paper, or any other material, until finish reaches full cure, but not less than seven days after applying last coat.

### 3.04 SCHEDULE

- A. The following levels are provided to establish the contract requirements for wood floor refinishing work. Refer to drawings for locations:
  - 1. Level 1: Clean and fine sand (screen) floors. Apply one (1) finish coat.
  - 2. Level 2: Completely sand floors to remove existing finish to bare wood. Stain and seal to match approved sample. Apply three (3) finish coats.

**END OF SECTION**

**SECTION 10 1101**  
**VISUAL DISPLAY BOARDS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Markerboards and Tackboards.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 09 2116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2009a.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's data on markerboard, tackboard, trim, and accessories.
- B. Shop Drawings: Indicate wall elevations, dimensions, joint locations .
- C. Samples: Submit color charts for selection of color and texture of markerboard, tackboard, tackboard surface covering, and trim.
- D. Test Reports: Show conformance to specified surface burning characteristics requirements.
- E. Manufacturer's printed installation instructions.

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. 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/#sle](http://www.claridgeproducts.com/#sle).
  - 2. MooreCo, Inc: [www.moorecoinc.com/#sle](http://www.moorecoinc.com/#sle).
  - 3. Polyvision Corporation (Nelson Adams): [www.polyvision.com/#sle](http://www.polyvision.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

- A. Markerboards: Porcelain enamel on steel, laminated to core.
  - 1. Color: White.
  - 2. Steel Face Sheet Thickness: 0.024 inch, 24 gage (0.61 mm).
  - 3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
  - 4. Face Sheet: Hardboard, thickness 1/4 inch.
  - 5. Backing: Aluminum sheet, laminated to core.
  - 6. Size: As indicated on drawings.
  - 7. Frame: Extruded aluminum, with concealed fasteners.

8. Frame Finish: Anodized, natural.
9. Accessories: Provide chalk tray and map rail.
  - a. Top rail with tack strip insert and display rail.
    - 1) Provide hangers for maps and audio visual aids.
- B. Tackboards: Fine-grained, homogeneous natural cork.
  1. Cork Thickness: 1/4 inch (6 mm).
  2. Color: As selected from manufacturer's full range.
  3. Backing: Hardboard, 1/4 inch (6 mm) thick, laminated to tack surface.
  4. Size: As indicated on drawings.
  5. Frame: Same type and finish as for markerboard, with concealed fasteners.
- C. Combination Units and Units Made of More Than One Panel: Factory-assembled markerboards and tackboards in a single frame, of materials specified above.
  1. Join panels of different construction with H-shaped extruded aluminum molding finished to match frame.
  2. Join panels of similar construction with butt joints, aligned and secured with steel spline concealed in edge of core.
  3. Configuration: As indicated on drawings.
  4. Units Too Large to Ship Assembled: Fully assembled in factory, then disassembled for shipping.

## 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 (0.13 mm) thick.
- D. Adhesives: Type used by manufacturer.

## 2.04 ACCESSORIES

- A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch (25 mm) wide overall, full width of frame.
- B. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.
- C. Temporary Protective Cover: Sheet polyethylene, 8 mil (0.2 mm) thick.
- D. Chalk Tray: Aluminum, triangular profile, one piece full length of chalkboard, closed ends; concealed fasteners, same finish as frame.
- E. 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.
- C. Verify flat wall surface for frameless adhesive-applied boards.

### 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.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Date of Substantial Completion.

**END OF SECTION**

**SECTION 10 2113.19**  
**PLASTIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments.
- B. Urinal screens.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 10 2800 - 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; 2015.
- B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 SUBMITTALS

- A. Product Data: Provide data on panel construction, hardware, and accessories.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

**PART 2 PRODUCTS**

2.01 MANUFACTURERS

- A. Solid Plastic Toilet Compartments:
  - 1. Basis of Design: Scranton Products (Santana/Comtec/Capital):  
[www.scrantonproducts.com/#sle](http://www.scrantonproducts.com/#sle).
  - 2. Substitutions: Section 01 6000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

- A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted unbraced.
  - 1. Doors:
    - a. Thickness: 1 inch (25 mm).
    - b. Width: 24 inch (610 mm).
    - c. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
    - d. Height: 55 inch (1397 mm).
  - 2. Panels:
    - a. Thickness: 1 inch (25 mm).
    - b. Height: 55 inch (1397 mm).
  - 3. Pilasters:
    - a. Thickness: 1 inch (25 mm).
    - b. Width: As required to fit space; minimum 3 inch (76 mm).
  - 4. Screens: Without doors; to match compartments; mounted to wall with continuous extruded aluminum panel brackets.

### 2.03 ACCESSORIES

- A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 inches (76 mm) high; concealing floor fastenings.
- B. Head Rails: Hollow anodized aluminum 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.
- C. Wall and Pilaster Brackets: Polished stainless steel; continuous type.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- E. 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 on shop drawings.
- 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 inch to 1/2 inch (9 mm to 13 mm) 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.

### 3.03 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

**END OF SECTION**

**SECTION 10 2800**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.
- B. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2011.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

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 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

**PART 2 PRODUCTS**

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
  - 1. Bobrick: [www.bobrick.com](http://www.bobrick.com)
  - 2. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 3. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 4. Kimberly-Clark: [www.kimberly-clark.com](http://www.kimberly-clark.com)
  - 5. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  - 1. Grind welded joints smooth.

- 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide 2 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES SCHEDULE

	Description	Manufacturer	Model #	Notes
<b>A</b>	<b>Not Used</b>			
<b>B</b>	<b>Soap Dispenser</b> Surface Mount			Furnished by Owner
<b>C</b>	<b>Paper Towel Dispenser</b>			Furnished by Owner
<b>D</b>	<b>Toilet Tissue Dispenser</b>			Furnished by Owner
<b>E</b>	<b>Mirror</b> Size: 24"W x 48"H (U.O.N.)	Bobrick	B-165	
<b>F</b>	<b>Grab Bar</b> (See drawings for sizes)	Bobrick	B-6806.99	
<b>G</b>	<b>Sanitary Napkin Disposal</b> Surface Mount	Bobrick	B-5270	

**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.

- D. See Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

### 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 in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

### 3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

**SECTION 10 4400**  
**FIRE PROTECTION SPECIALTIES**

**PART 2 PRODUCTS**

1.01 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

**END OF SECTION**

**SECTION 12 2413**  
**WINDOW TREATMENT – ROLLER SHADES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Manual roller shades with light filtering fabric for exterior clear glazed windows.

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 TYPE WT-1

- A. Basis of specification
  1. Basis of Design: MechoShade Systems, Inc.
  2. Window Treatment Fabric:
    - a. ThermoVeil 1300 Series, Dense Basket Weave, 5% openness factor.
  3. Roller shade assembly:
    - a. MechoShade: MechoShade/5
  4. Color: One standard color as selected by Architect from manufacturer's standard color palette.
  5. 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.
  6. Direction of Roll: Regular, from back of roller.
  7. Mounting Brackets: Standard 1018 plated steel. Sizes to be compatible with window /shade size and clutch capacity. Bracket style to be compatible with mounting requirements and site conditions.
  8. 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.

9. Shade Operation: Manual - with continuous loop bead chain, clutch, and cord tensioner and bracket lift operator.
  10. 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.
  11. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
  12. Lift Assist Mechanism: Manufacturer's standard spring assist for balancing roller shade weight and lifting heavy roller shades.
  13. Bead Chain: Nickel-plated metal or Stainless steel.
  14. Cord Tensioner Mounting: As required per installation.
  15. Operating Function: Stop and hold shade at any position in ascending or descending travel.
- B. Accessories:
1. Fascias: As required by installation. One-piece extruded aluminum.
  2. Manufacturer's standard hem bar.
  3. End caps.

### 2.03 ROLLER SHADE FABRICATION

- A. 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.
- B. Concealed Components: Non-corrodible or corrosion-resistant-coated materials.
1. Lifting Mechanism: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
1. Shade Units installed outside (typical) : If inside mount is required, edge of shade not exceed 1/4 inch from face of jamb.
  2. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
  3. Fabricate shadecloth to hang flat without buckling or distortion.
- D. Installation Brackets: Shall allow for easy removal and reinstallation of shade, operating hardware and for hardware position and shade mounting method indicated.
- E. 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.
- F. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range, unless otherwise indicated.

### 2.04 MANUAL ROLLER SHADE TYPE WT-2

- A. Basis of specification
1. Basis of Design: MechoShade Systems, Inc.
  2. Window Treatment Fabric:
    - a. ThermoVeil 1300 Series, Dense Basket Weave, 5% openness factor.
  3. Roller shade assembly:
    - a. Apply new shade cloth to existing rollers
  4. Direction of Roll: Regular, from back of roller.
  5. 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.

6. Shade operation: Manual - with continuous loop bead chain, clutch, and cord tensioner and bracket lift operator.

### **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. 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 following locations:
  1. All exterior windows within scope limits, except windows serving corridors, stair towers, vestibules, toilet rooms, and storage rooms.
  2. Elsewhere as noted on drawings.

**END OF SECTION**

**SECTION 12 3400**  
**LAMINATE CLAD CASEWORK**

**PART 1 – GENERAL**

1.01 SECTION INCLUDES

- A. Fixed modular laminate clad casework and components.
- B. Countertops and backsplashes.

1.02 RELATED SECTIONS

- A. Section 06100: Blocking within walls where indicated.
- B. Section 09 6500 - Resilient Flooring: Base molding.
- C. Section 12 3600: Countertops
- D. Division 15: Sinks and service fixtures, service waste lines, connections, and vents.
- E. Division 16: Electrical service fixtures.

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 01300, 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 01600 . Other manufacturers shall comply with the minimum levels of material and detailing indicated on the drawings or as specified.

#### 2.02 MATERIALS

- A. 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 thick: 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 12 colors per project. Refer to Finish Schedule.
- D. Edging Materials:
  1. Cabinet Body: 1mm PVC banding, machine applied.
  2. Door and counter edges: 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius.

### 2.03 SPECIALTY ITEMS

- A. Support Members:
  1. Countertop support brackets: Epoxy powder coated, 11 gauge steel with integral cleat mount opening and wire management opening.
  2. Undercounter support frames: Epoxy powder coated.
  3. Legs: Epoxy powder coated.

### 2.04 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).
  2. Stainless Steel Wire Pulls (4 inch).
- C. Drawer Slides:
  1. Regular, knee space and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.
    - a. Paper storage, 150-pound load rated epoxy coated steel slides.
  2. File: 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.
- F. Coat Rods: 1 inch diameter, 14-gauge chrome plated steel installed in captive mounting hardware.

G. File Suspension System: Extruded molding integral with top of drawer box sides to accept standard hanging file folders.

H. Mirrors: 1/4 inch thick polished mirror plate.

#### 2.05 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.

#### **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 Wilsonart, Formica, and Nevamar 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 3600**  
**COUNTERTOPS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Countertops for manufactured casework.
- B. Wall-hung counters and vanity tops.
- C. Solid surface window stools.

1.02 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
- E. IAPMO Z124 - Plastic Plumbing Fixtures; 2012.
- F. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- H. PS 1 - Structural Plywood; 2009.

1.03 SUBMITTALS

- A. See Section 01 3000 - 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 (150 mm) square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Installation Instructions: Manufacturer's installation instructions and recommendations.
- H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.04 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.

### 1.05 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 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
  - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
    - a. Finish: Matte or suede, gloss rating of 5 to 20.
    - b. Surface Color and Pattern: As indicated on drawings.
  - 2. Exposed Edge Treatment: 3 mm edge banding, machine applied and machine profiled to 1/8 inch radius. Color as selected from manufacturer's standard range of minimum 15 colors.
  - 3. Back and End Splashes: Same material, same construction.
- C. Solid Surfacing Countertops and Window Stools: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Basis of Design: Dupont; Corian: [www.corian.com](http://www.corian.com)
    - b. Acceptable Manufacturers:
      - 1) Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
      - 2) Meganite, Inc: [www.meganite.com/#sle](http://www.meganite.com/#sle).
      - 3) Substitutions: See Section 01 6000 - Product Requirements.
    - c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - d. Color and Pattern: As indicated on drawings.
  - 3. Other Components Thickness: 1/2 inch (12 mm), minimum.
  - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; eased edge top and bottom.
  - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

### 2.02 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 6000 - Product Requirements.
- B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) 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 (25 mm) 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 (102 mm), unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

## **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 (16 mm).
- 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 Date of Substantial Completion.

**END OF SECTION**

**SECTION 06 8000**  
**COMPOSITE FABRICATED WALL PANELS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Lightweight, seamless, fully encapsulated, composite material used to create interior, shop-fabricated, shop-finished, non-structural, architectural elements.
  - 1. Accoustical wall panels

1.02 RELATED REQUIREMENTS

- A. Include applicable section numbers.
  - 1. Section [26 51 00] [Wall Sconce] - Interior Lighting: Interior lighting to be shop installed into architectural elements.

1.03 REFERENCE STANDARDS

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. Comply with Section 01 3300 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including:
  - 1. Delivery, storage, and handling instructions.
  - 2. Preparation and installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating dimensions and installation hardware.
  - 1. Field Dimensions: For coordination or installation.
- D. Interior Lighting: Location and mounting of interior lighting.
- E. Samples: Submit manufacturer's sample of each finish material and color, minimum 4 inches by 4 inches.
- F. Cleaning Instructions: Submit manufacturer's cleaning instructions.
- G. Warranty Documentation: Submit manufacturer's standard warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged, for past 10 years, in manufacture of architectural elements of similar type to that specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
  - 1. Store and handle materials in accordance with manufacturer's instructions.
  - 2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
  - 3. Do not stack materials.
  - 4. Store materials in interior, clean, dry, conditioned area.
  - 5. Store materials on flat, level surface, raised above floor, with adequate support to prevent sagging.
  - 6. Store materials out of direct sunlight and away from heat sources.
  - 7. Keep materials from freezing.

8. Protect materials and finish during storage and handling to prevent damage.
9. Do not cut, scratch, dent, mark, or otherwise damage architectural elements when handling.
10. Avoid stress to architectural elements.
11. Prevent chipped edges and corners of architectural elements.
12. Wear clean, non-abrasive gloves when handling architectural elements.

#### 1.07 AMBIENT CONDITIONS

- A. Install architectural elements in interior, controlled environments:
  1. Air Temperature: Between 50 and 90 degrees F (10 and 32 degrees C).
  2. Relative Humidity: Between 25 and 55 percent.

### **PART 2 PRODUCTS**

#### 2.01 MANUFACTURER

- A. KMDI, Inc., 400 Funston Road, Kansas City, Kansas 66115. Toll Free 800-474-5004. Phone 913-281-4200. Fax 913-281-0208. [www.kmdi.net](http://www.kmdi.net) <<http://www.kmdi.net>>. [projectdevelopment@kmdi.net](mailto:projectdevelopment@kmdi.net) <<mailto:bbb@aaaa.com>>.
- B. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.02 MATERIALS

- A. Architectural Elements: "MicroLite!"
  1. Description: Proprietary, lightweight, seamless, fully encapsulated, composite material.
  2. Use: Create interior, shop-fabricated, shop-finished, non-structural, architectural elements.
  3. Surface Burning Characteristics, ASTM E 84: Class A.
- B. Acoustical Batt Insulation: Non-combustible, lightweight, semi-rigid stone wool batt insulation to,ASTM C655Type 1, that provides fire resistance to ASTM E136and sound control to ASTM E423.
  1. Fire performance:
    - a. Non-combustibility: To ASTM E136.
    - b. Surface Burning Characteristics: To ASTM E84.
      - 1) Flame spread: 0.
      - 2) Smoke developed: 0.
  2. Acoustical Performance:
    - a. Airborne sound transmission loss: To ASTM E90.
    - b. Rating sound insulation: To ASTM E413.
    - c. Sound absorption co-efficients: To ASTM E423.

#### 2.03 FABRICATION

- A. Shop Fabrication: Shop fabricate architectural elements to dimensions and shapes indicated on the Drawings.
- B. Interior Lighting: Specified in Section [26 51 00] [Wall Sconce].
- C. Shop install interior lighting in architectural elements at locations indicated on the Drawings.
- D. Field Fabrication: Not acceptable.

#### 2.04 FINISHES

- A. Shop Finishing: Shop finish architectural elements.
  1. Finsh: TBD
- B. Field Finishing: Not acceptable.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine surrounding area and supporting structure to receive architectural elements.
- B. Verify field dimensions.
- C. Notify Architect of conditions that would adversely affect installation or subsequent use.
- D. Do not begin installation until unacceptable conditions are corrected.

#### **3.02 PREPARATION**

- A. Install supports as required for installation of architectural elements.
- B. Clean installation area of dirt, dust, debris, and other items that could damage finish of architectural elements.
- C. Wear clean, non-abrasive gloves when preparing and installing architectural elements.
- D. Lay out architectural element components on manufacturer's packing material from shipping to protect finish of architectural elements.
- E. Do not discard manufacturer's packing material until installation is complete.

#### **3.03 INSTALLATION**

- A. Install architectural elements in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install architectural elements plumb and level, unless otherwise indicated on the Drawings.
- C. Support architectural elements securely in place.
- D. Use installation hardware furnished by manufacturer.
- E. Do not cut, scratch, dent, mark, or otherwise damage architectural elements during installation.
- F. Interior Lighting: Install wiring to interior lighting in architectural elements as specified in Section [26 51 00] [Wall Sconce].

#### **3.04 ADJUSTING**

- A. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Return damaged architectural elements to manufacturer that cannot be successfully repaired in the field, as determined by Architect.

#### **3.05 CLEANING**

- A. Clean architectural elements promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.
- C. Use non-abrasive surface cleaner and soft, non-abrasive cloths.

#### **3.06 PROTECTION**

- A. Protect installed architectural elements from dirt, dust, and damage during construction.

**END OF SECTION**

## SECTION 07 4233

### INTERIOR SOLID PHENOLIC DECORATIVE PANELS

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES:

- A. Interior solid phenolic decorative wall panels.
- B. Aluminum supporting substructure.

##### 1.02 SYSTEM DESCRIPTION:

- A. Decorative Wall Panel Assembly: Solid phenolic core, fire-retardant, wall panels, aluminum substructure, attachment system components, and all accessories.

##### 1.03 PERFORMANCE REQUIREMENTS:

- A. General Performance: Solid phenolic decorative wall panel system, aluminum substructure, and attachment accessories shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Aluminum Support System: Provide aluminum support system capable of the following:
  - 1. Design and install aluminum support structure to accommodate expected construction tolerances and misalignment, deflection of building structural components, and openings in the building enclosure as designed.

##### 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include Manufacturer's written installation instructions, including recommendations for evaluating, preparing, and treating substrate, rain screen panel technical data, material descriptions, and finishes and tested physical and performance properties.
- B. Shop Drawings: Show fabrication and installation layouts of solid phenolic panel, details of aluminum support structure conditions, anchorages for aluminum support structure, attachment system for panels, allowances for thermal expansion, trim, flashings, closures, corners, and accessories as required, and all special job specific details.
- C. Samples: For each type of exposed finish required, prepared on samples of size and type indicated below for approval:
  - 1. Wall Panels: Minimum 4 inch by 4 inch including fasteners of each color.
  - 2. Aluminum Support Structure: 12-inch-long including fasteners and other accessories.
- D. Installer Qualification Data: For Installer, provide certification signed by solid phenolic rainscreen panel Manufacturer certifying that Installer complies with requirements to perform the work specified in this Section.
- E. Closeout Submittals: From solid phenolic panel Manufacturer, provide the following:
  - 1. Operation and Maintenance Data: Operation and maintenance manuals including methods for maintaining installed products, replacing damaged panels, and precautions against cleaning materials and methods detrimental to finishes and performance.
  - 2. Warranty: 10 year limited warranty for solid phenolic exterior rain screen wall panel system. Warranty shall be inclusive of material and labor for removal and reinstallation.

##### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in the installation of exterior rain screen wall panel systems who has a minimum of 3 years experience.

- B. Fabricator Qualifications: A shop that employs skilled workers who custom fabricate solid phenolic or similar exterior rain screen wall panel systems to those required for this Project and who is certified by the Manufacturer.
- C. Source Limitations: Obtain solid phenolic panels and all auxiliary materials from a single-source Manufacturer or an accessory Manufacturer who is certified by the solid phenolic rain screen panel Manufacturer.
  - 1. Panels shall be manufactured in accordance with ISO9001, ISO14001 and EN 16001
- D. Pre-Installation Conference: Conduct pre-installation conference at Project site prior to commencing construction of mock-up specified herein to verify Project requirements.
  - 1. Review solid phenolic panel installation requirements including substrate surface preparation, environmental limitations, typical details, Manufacturer's recommended installation procedures, coordination with adjacent trades, testing and inspection procedures, protection and repair procedures.
  - 2. Ensure all sub-trades interfacing with or affected by the construction of the solid phenolic panel system are present, including Architect, General Contractor, solid phenolic panel Manufacturer, and any other installer whose work interfaces with or affects the solid phenolic rain screen wall panels.

#### 1.06 PROJECT CONDITIONS, STORAGE, AND HANDLING

- A. Field Measurements: Verify actual panel measurements/openings by field measurement before fabrication to accommodate site tolerances and changes in construction.
- B. Deliver solid phenolic panel materials, aluminum support structure, and other manufactured accessory materials in Manufacturer's original, unopened, and undamaged containers with identification labels intact and visible. Package solid phenolic rain screen panels for protection during transportation and handling. Comply with Manufacturer's and Distributor's written delivery and handling guidelines.
- C. Store solid phenolic rain screen panels horizontally, covered with suitable weather tight and ventilated covering to prevent exposure to UV light and to ensure dryness with positive slope for drainage. Do not store panels in contact with ground or with materials that might cause staining, damage, scratching, or other surface damage.
- D. Phenolic panel installer shall notify the General Contractor immediately upon discovery of any issues with the substrate prior to continuation of panel system installation.
- E. Remove damage and waste panel material from site and legally dispose of according to authorities having jurisdiction.

#### 1.07 WARRANTY

- A. Submit Manufacturer's standard 10 year warranty covering defects in material.

### **PART 2 - PRODUCTS**

#### 2.01 SOLID PHENOLIC WALL PANELS

- A. General: Subject to compliance requirements, provide solid phenolic wall panels for interior wall applications:
  - 1. Basis of Design: Trespa Meteon
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Product Description:
  - 1. Panel Material: Solid phenolic resin, fire-retardant exterior grade rainscreen panel with double hardened thermally cured NT surface finish
  - 2. Panel Finish: finish as selected by Architect from Manufacturer's standard color range.

3. Color A: A22.4.4 Brilliant Blue
4. Color B: A422.2.4 Powder Blue
5. Color C: A22.3.1 Ocean Grey
6. Panel Finish Color shall be on both sides of panel.
7. Panel Core: Standard brown core.
8. Panel Thickness: 13mm.
9. Standard Sizes: As indicated on drawings.
10. Substructure: Exposed Fastener Type extruded aluminum profiles, clips, closures, and tees and indicated on the project drawings.

C. Physical Properties:

1. Smoke Development Index: Less than 40 per ASTM E-84.
2. Flame Spread Index: Less than 10 per ASTM E-84.
3. Panels shall have UV and weather resistance performance with a grey scale rating minimum of 4-5 per ISO 4892-2, 4892-3.
4. Panels shall be impact resistant per EN-ISO 178
5. Panels shall be scratch resistant per EN-438-6
6. Panels shall have a Hail Impact Resistance (HIR) rating of 5 (no damage)
7. Panels shall be ICC AC92 compliant and have ICC Evaluation Services Report.

2.02 AUXILIARY MATERIALS

- A. Aluminum Support Structure: Extruded, finished, and color-matched for the type of use indicated on project Drawings.
- B. Attachment Accessories: Of type, size, corrosion-resistance, holding-power and color-matched as required to suit attachment to aluminum support structure.

2.03 FABRICATION

- A. General: Fabricate solid phenolic wall panels and accessory materials in accordance with Manufacturer's written instructions and approved submittals, and at a fabrication facility trained and approved by Manufacturer. Comply with indicated profiles and within dimensional and structural requirements.

**PART 3 - EXECUTION**

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances of structural substrate, aluminum support structure, solid phenolic rain screen panel, and other conditions affecting performance.
  1. Verify that substrate conditions are acceptable for product installation and within acceptable tolerances in accordance with Manufacturer's written instructions.
  2. Examine rough-in installation for components and systems adjacent to and penetrating into solid phenolic rain screen panels to verify actual locations of penetrations relative to joint locations of panels prior to panel installation.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Aluminum Support Structure: Install clips, L-shapes, J-shapes, Z-shapes, hat channels, fillers, and other components in accordance with approved Shop Drawings and Manufacturer's recommended installation instructions.

- B. Install aluminum support structure framing level and plumb and within tolerances of the completed system as approved and recommend by Manufacturer and in accordance with approved Shop Drawings.

### 3.03 SOLID PHENOLIC PANEL INSTALLATION

- A. Install solid phenolic panels plumb and level and accurately spaced per Manufacturer's written installation instructions and in accordance with approved Shop Drawings.
- B. Fasten solid phenolic wall panels to aluminum support structure with fasteners approved for use with adjoining construction and in accordance with approved Shop Drawings for color matching and to confirm compliance with wind load and engineering design requirements.
- C. Accessory Rain screen System Materials: Install corner profiles, gaskets, trim, and joint closure strips as required with fasteners and adhesive appropriate for use with adjoining construction as indicated on drawings and as recommended by Manufacturer.
- D. Erection Tolerances: Install aluminum support structure within the required installation tolerances as recommended by Manufacturer and in accordance with approved Shop Drawings.
- E. Do not apply sealant to solid phenolic panel joinery unless otherwise indicated on Drawings or in accordance with Manufacturer's recommended installation instructions.

### 3.04 CLEANING

- A. Upon completion of solid phenolic wall panel installation clean finished surfaces as recommended by panel Manufacturer prior to Owners' acceptance.
- B. Legally dispose of all surplus materials off site.

**END OF SECTION**

**SECTION 08 1114**  
**PREFINISHED STEEL DOORS FRAMES**

**PART 1 - GENERAL**

1.01 WORK INCLUDED

- A. The work under this section shall include the furnishing of all items shown on the drawings and as specified, including but not limited to, the following:
  - 1. Knocked down, site assembled prefinished steel door frames.

1.02 RELATED SECTIONS

- A. Section 01 60 00 - Product Requirements
- B. Section 08 14 16 - Flush Wood Doors
- C. Section 08 71 00 - Hardware
- D. Section 08 80 00 - Glazing

1.03 REFERENCES

- A. ASTM A653 - Standard for hot dipped galvanized steel material
- B. UBC 7-2-97, UBC 7-4-97 Positive Pressure Fire Test Certification.
- C. UL 10B Fire test of Door Assemblies and UL10C Standard for Positive Pressure Fire Tests of Door Assemblies
- D. NFPA 80 - Fire Doors and Windows (Latest Edition)
- E. NFPA-101 - Life Safety Codes (Latest Edition)
- F. ASTM D2197 - Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion.
- G. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
- H. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- I. ASTM D3361 - Standard Practice for Unfiltered Open-Flame Carbon-Arc exposures of Paint and Related Coatings.
- J. ASTM B117 - Standard test for salt spray testing

1.04 SUBMITTALS

- A. Section 01 33 00: Submittal procedures.
- B. Product Data: Indicate frame material, gauge, configuration and finishes.
- C. Shop Drawings: Indicate frame elevations, details of frame anchorage, reinforcements required, rough opening requirements, location of hardware embosses, and finishes separately.
- D. Samples: Submit two 3 inch by 3 inch samples, illustrating each standard factory finished frame colors.
- E. Manufacturer's Installation Instructions: Provide installation instructions for all products under this section.
- F. Manufacturer's Certificate of Warranty: Provide manufacturer's standard warranty certificate stating material is warranted for a period of one year from date of building occupancy

### 1.05 QUALITY ASSURANCE

#### A. Quality Standards

1. Material free from defects in material and according to project specifications for pre-engineered opening systems
2. Proven durability of factory finishes allowing for bending and shaping of material after finish is applied

#### B. Installed Frame Assembly: Conform to NFPA 80

1. Use only installers familiar with installation of prefinished opening systems and applied casing frame installation

### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00: Transport, handle, store, and protect products in a dry area off the ground.
- B. Accept frames on site in manufacturer's box packaging with identification labels intact. Inspect for damage.
- C. Do not open individual boxes until installation is to begin.

## **PART 2 - PRODUCTS**

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Timely Industries, A Division of SDS Industries, Inc., 10241 Norris Avenue, Pacoima, CA, 91331-2292; Phone toll free: 800-247-6242; Fax: 818-492-3530. Web site: [www.timelyframes.com](http://www.timelyframes.com) <<http://www.timelyframes.com>>.
- B. Frames: Provide interior frames for project areas as shown on plans and door schedule.
- C. Substitutions: Refer to Section 01600

### 2.02 FRAMES

- A. Frame Material: Hot dipped galvanized steel, for interior frames in normal atmospheric exposures.
- B. Frame Throat Opening: As shown on plan details to suit finished wall thickness.
- C. Frames to have kerf formed into frame profile for installation of smoke gasket or weatherstrip material
- D. Frame Profile - Unequal Rabbet profile, standard with manufacturer
  2. "CK" Series, 1.2 mm (18 gauge) thick, with kerf for door seal/gasket
- E. Casings
  1. Provide TA-8 steel casing.

### 2.03 FRAME REINFORCEMENT AND ACCESSORIES

- A. Provide reinforcements shipped loose to project site for hardware application
  1. TA-10 - Regular arm closers, casing mounted door guards and coordinators
  2. TA-12 - Parallel arm closers, Rim Exit device strikes, other stop mounted surface hardware
  3. TA-47 - For CK frame, Parallel arm closers, Rim Exit device strikes, other stop mounted surface hardware
  4. TA-25 - Double acting spring hinges, continuous hinges, other surface mounted hardware on door rabbet or cased opening frame
  5. Provide hinge reinforcement (TA-11) of 14 gauge steel pierced to create depth of thread for hinge screws equal to or exceeding 10 gauge steel.
  6. Provide cut-outs and reinforcement for mortised hardware - see section 08 71 00

- B. Weatherstrip/Smoke Gasket: TA-46 (QDS500) 90 minute rated gasket for kerfed frames. Provide prefinished frames with factory installed TA-46. All pieces factory mitered to assure perfect corner alignment. Select color: Black
- C. Installation fasteners (Provided by others)
  - 1. Interior Frames: #6 Drywall type - length sufficient to penetrate studs or structure at least ½”.

#### 2.04 FABRICATION

- A. Openings for single swing, pair, borrowed light and sidelight frames to be pre-cut, notched and fabricated at the manufacturer’s facility. Provide kerf at stop for installation of smoke gasket.
- B. Provide hinge reinforcement (TA-11) of 14 gauge steel pierced to create depth of thread for hinge screws equal to or exceeding 7 gauge steel. Hinge plate to be mechanically attached to hinge emboss on frame
- C. Casing Clips: Fabricate frames with factory applied, heat treated clips to ensure no deflection in the clip upon application or removal of casing. Attachment clips may not be of same material as frame
- D. Provide notches, tabs and/or stops for positive alignment of frame parts at all corners
- E. Factory install TA-46 smoke gasket on all prefinished, CK series frames. Install with factory mitered corners to ensure adequate seal and pleasing appearance

#### 2.05 FINISHING

- A. Frame Units: Prefinished with factory applied impact resistant, polyester baked enamel finish or optional electrostatic applied water based paint system
- B. Frames for high humidity areas to be electro galvanized. See 2.02.B for specific locations
- C. Casing Finishes
  - 1. Factory painted to match frame.
- D. Colors to be selected from:
  - 1. Standard Colors

### **PART 3 - EXECUTION**

#### 3.01 EXAMINATION

- A. Verify acceptability of existing conditions before starting work.
- B. Verify that opening sizes and wall thicknesses are within specified tolerances. Verify that all finished walls are in plane to ensure proper door alignment.

#### 3.02 INSTALLATION

- A. Install frames in accordance with manufacturer’s requirements.
- B. Anchor frames with screws located at every casing clip or every 11” as shown on manufacturer’s instructions. Field verify quantity and location of fasteners prior to installing casing.
- C. Install prefinished frames near end of the project after wall painting and wall coverings.
- D. Install frames using qualified installers familiar with installation of prefinished drywall frames.
- E. Coordinate installation of frames with installation of hardware specified in Section 08 7100 and doors in Section 08 1416.

F. Touch-up blemishes on finished frames with factory prepared touch up paint.

**END OF SECTION**

**SECTION 08 1416**  
**FLUSH WOOD DOORS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 1114 - Prefinished Steel Door Frames
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. AWI/AWMA/WI (AWS) - Architectural Woodwork Standards; 2014.
- B. AWMA/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
- C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: Submit two samples of door veneer, 4 by 4 inch (\_\_\_\_ by \_\_\_\_ mm) in size illustrating wood grain, stain color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.
- F. Specimen warranty.
- G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:
  - 1. Eggers Industries; \_\_\_\_: [www.eggersindustries.com/#sle](http://www.eggersindustries.com/#sle).
  - 2. Graham Wood Doors; \_\_\_\_: [www.grahamdoors.com/#sle](http://www.grahamdoors.com/#sle).
  - 3. Marshfield DoorSystems, Inc; \_\_\_\_: [www.marshfielddoors.com/#sle](http://www.marshfielddoors.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 DOORS AND PANELS**

- A. Doors: Refer to drawings for locations and additional requirements.
  - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
  - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.
  - 2. Wood veneer facing with factory transparent finish to be selected for factory standard finishes.

### **2.03 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

### **2.04 DOOR FACINGS**

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
  - 1. Vertical Edges: Same species as face veneer.

### **2.05 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at lock edge for hardware reinforcement.
  - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

### **2.06 FACTORY FINISHING - WOOD VENEER DOORS**

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
  - 1. Transparent:
    - a. System - TR-6, Catalyzed Polyurethane.
    - b. Stain: As selected by Architect.

c. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

#### 2.07 ACCESSORIES

A. Prefinished Steel Door Frames: As specified in Section 08 1114.

B. Glazing: As specified in Section 08 8000.

C. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.

### **PART 3 EXECUTION**

#### 3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

#### 3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

#### 3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

#### 3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

#### 3.05 SCHEDULE

A. See Drawings.

**END OF SECTION**

**SECTION 08 5113**  
**ALUMINUM WINDOWS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Projected and Fixed Windows.
- B. Casement window for roof access.
- C. Operating hardware.
- D. Insect screens.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Rough opening framing.
- B. Section 06 1000 - Rough Carpentry: Wood perimeter shims.
- C. Section 07 9200 - Joint Sealants: Sealing joints between window frames and adjacent construction.
- D. Section 08 8000 - Glazing.

1.03 SPECIAL NOTES

- A. Removal of existing windows and doors shall be done by the Abatement Contractor under separate contract with the School District. The Window Contractor and the Abatement Contractor shall be responsible for coordinating their respective work and schedules with each other.
- B. Removal of existing blinds and shades and interior patching (floors, walls and ceilings) shall be done under separate contract with the School District.
- C. Refer to drawings for Window Schedule

1.04 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2017.
- B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

- J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- M. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

#### 1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, window location chart, details, and installation requirements.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
  - 1. Evidence of AAMA Certification.
  - 2. Evidence of WDMA Certification.
  - 3. Evidence of CSA Certification.
  - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 10 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least 5 years of documented experience.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

#### 1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
- B. Maintain this minimum temperature during and 24 hours after installation of sealants.

## 1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- C. Provide (20) Twenty 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 MANUFACTURERS

- A. Basis of Design: TRACO.
  - 1. Fixed : Series 2800
  - 2. Projecting in : Series 2400
  - 3. Casement swing out : 2100
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
  - 1. EFCO, a Pella Company; Series 550I: [www.efcocorp.com/sle](http://www.efcocorp.com/sle).
  - 2. Winco Series 1150.
  - 3. Graham Series 6500.
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### 2.02 WINDOWS

- A. Aluminum Windows: Traco - Flush Projected Heavy Commercial Thermal Aluminum Windows. Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
  - 1. Frame Depth: 2-1/4 inches (57.1 mm).
  - 2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
  - 3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
  - 4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
  - 5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Performance Requirements: Provide products that comply with the following:
  - 1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
    - a. Performance Class (PC): AW.
  - 2. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf (580 Pa).
  - 3. Air Leakage: Maximum of 0.1 cu ft/min sq ft (0.5 L/sec sq m) per unit area of outside frame dimension, with 6.27 psf (300 Pa) differential pressure when tested in accordance with ASTM E283.
  - 4. Condensation Resistance Factor of Frame: 50, measured in accordance with AAMA 1503.
- C. Fixed, Non-Operable Type:
  - 1. Construction: Thermally broken.

2. Glazing: Double; gray tinted/clear; low-e.
  3. Exterior Finish: Superior performing organic coatings.
  4. Interior Finish: Superior performing organic coatings.
- D. Outswinging Casement Type (for roof access):
1. Construction: Thermally broken.
  2. Glazing: Double; gray tinted/clear; low-e.
  3. Exterior Finish: Superior performing organic coatings.
  4. Interior Finish: Superior performing organic coatings.
  5. Hardware: std cam handles; 12" limit stop on operating vents
  6. Prevention of unauthorized use – removable handle or lock
  7. Accessories: Receptors; Subsill; 3 pc mullions and interior trim as req'd
- E. Inswinging Hopper Type:
1. Construction: Thermally broken.
  2. Provide insect screens for operating vents with aluminum dark mesh
  3. Glazing: Double; gray tinted/clear; low-e.
  4. Exterior Finish: Superior performing organic coatings.
  5. Interior Finish: Superior performing organic coatings.
  6. Hardware: std cam handles; 12" limit stop on operating vents
  7. Accessories: Receptors; Subsill; 3 pc mullions and interior trim as req'd

### 2.03 COMPONENTS

- A. Frames: 2 inch (\_\_\_\_ mm) wide by 2-1/4 inch (\_\_\_\_ mm) deep profile, of 1/2 inch (\_\_\_\_ mm) thick section; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.
- B. Glazing: As specified in Section 08 8000.
- C. Insect Screens: Extruded aluminum frame with mitered and reinforced corners; screen mesh taut and secure to frame; secured to window with adjustable hardware allowing screen removal without use of tools.
1. Hardware: Spring loaded steel pins; four per screen unit.
  2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's standard mesh.
  3. Frame Finish: Same as frame and sash.
- D. Operable Sash Weatherstripping: Resilient plastic; permanently resilient, profiled to achieve effective weather seal.
- E. Fasteners: Stainless steel.
- F. Glazing Materials: As specified in Section 08 8000.
- G. Sealant and Backing Materials: As specified in Section 07 9200

### 2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5005 alloy, H12 or H14 temper.
- C. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

### 2.05 HARDWARE

- A. Sash lock: Lever handle with cam lock.
- B. Limit Stops: Resilient rubber.

## 2.06 FINISHES

- A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
  - 1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 1.2 mil (\_\_\_ mm); color and gloss as scheduled.
    - a. Manufacturers:
      - 1) PPG Metal Coatings; Duranar: [www.ppgideascales.com/#sle](http://www.ppgideascales.com/#sle).
      - 2) Substitutions: See Section 01 6000 - Product Requirements.
- B. Finish Color: Benjamin Moore : Bermuda Turquoise 728.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

### 3.02 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Install sill and sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- F. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.
- G. Install operating hardware not pre-installed by manufacturer.
- H. Install glass and infill panels in accordance with requirements specified in Section 08 8000.
- I. Install perimeter sealant in accordance with requirements specified in Section 07 9200

### 3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

### 3.04 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

### 3.05 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

- D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

**END OF SECTION**

**SECTION 08 71 00  
DOOR HARDWARE**

**PART 1 – GENERAL**

**1.01 SUMMARY**

- A. Section includes furnishing and installation of door hardware for doors specified in “Hardware Sets” and required by actual conditions. Including screws, bolts, expansion shields, electrified door hardware, and other devices for proper application of hardware.
- B. Where items of hardware are not specified and are required for intended service, such omission, error or other discrepancy to be submitted to Architect fourteen calendar days prior to bid date for clarification by addendum.
- C. Products supplied but not installed under this Section:
  - 1. Hardware for aluminum doors will be furnished under this Section, but installed under Division 08 Openings
  - 2. Hold open wall magnets.
  - 3. Electrified hardware will be furnished under this Section, but installed by the security contractor.
- D. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- E. Related Divisions:
  - 1. Division 08 Openings
  - 2. Division 13 Special Construction
  - 3. Division 26 Electrical
  - 4. Division 28 Electronic Safety And Security

**1.02 REFERENCES**

- A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):
  - 1. ANSI/BHMA A156.1 Butts & Hinges (2006)
  - 2. ANSI/BHMA A156.3 Exit Devices (2014)
  - 3. ANSI/BHMA A156.4 Door Controls – Closers (2008)
  - 4. ANSI/BHMA A156.6 Architectural Door Trim (2010)
  - 5. ANSI/BHMA A156.7 Template Hinge Dimensions (2009)
  - 6. ANSI/BHMA A156.8 Door Controls – Overhead Stops and Holders (2010)
  - 7. ANSI/BHMA A156.13 Mortise Locks & Latches (2005)
  - 8. ANSI/BHMA A156.14 Sliding & Folding Door Hardware (2007)
  - 9. ANSI/BHMA A156.16 Auxiliary Hardware (2008)
  - 10. ANSI/BHMA A156.18 Materials & Finishes (2006)
  - 11. ANSI/BHMA A156.21 Thresholds (2009)
  - 12. ANSI/BHMA A156.22 Door Gasketing Systems (2012)
  - 13. ANSI/BHMA A156.25 Electrified Locks (2007)
  - 14. ANSI/BHMA A156.26 Continuous Hinges (2006)
  - 15. ANSI/BHMA A156.28 Keying Systems (2007)
  - 16. ANSI/BHMA A156.32 Integrated Door Assemblies (2008)
  - 17. ANSI/BHMA A156.36 Auxiliary Locks (2010)
  - 18. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames (2014)
  - 19. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames (2006)
- B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
  - 1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2009

2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- C. Underwriters Laboratories, Inc. (UL):
1. UL 10C Positive Pressure Fire Test of Door Assemblies
  2. UL 1784 Air Leakage Test of Door Assemblies
  3. UL/ULC Listed
- D. Door and Hardware Institute (DHI):
1. DHI Publication – Keying Systems and Nomenclature (1989)
  2. DHI Publication – Abbreviations and Symbols
  3. DHI Publication – Installation Guide for Doors and Hardware
  4. DHI Publication – Sequence and Format of Hardware Schedule (1996)
- E. National Fire Protection Agency (NFPA)
1. NFPA 70 National Electrical Code 2014
  2. NFPA 80 Standard for Fire Doors and Other Opening Protective's 2013
  3. NFPA 101 Life Safety Code 2015
  4. NFPA 105 Standard for the Installation of Smoke Door Assemblies 2013
- F. Building Codes
1. IBC International Building Code 2015
  2. Local Building Code

### 1.03 SUBMITTALS

- A. Submit in accordance with Conditions of the Contract and Division 1 Administrative Requirements.
- B. Shop Drawings:
1. Organize hardware schedule organized in vertical format illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and symbols page according to DHI Publications Abbreviations and Symbols. Complete nomenclature of items required for each door opening as indicated.
  2. **Include lock, latch or trim function (Entry, Classroom, Passage, etc.) in the product description under the Hardware Headings to matching the actual function as indicated by the product catalog number.**
  3. Coordinate final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.
  4. Architectural Hardware Consultant (AHC), as certified by DHI, who shall affix seal attesting to completeness and correctness, shall review hardware schedule prior to submittal.
- C. Submit manufacturer's catalog sheet on design, grade and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide index, and cover sheet.
- D. Coordination: Distribute door hardware templates to related divisions within fourteen days of receiving approved door hardware submittals.
- E. Electrified Hardware: Provide electrical information to include voltage, and amperage requirements for electrified door hardware and description of operation.
1. Description of operation for each electrified opening to include description of component functions including location, sequence of operation and interface with other building control systems.
  2. Wiring Diagrams: Detail wiring for power, signal, and control system and differentiate between manufacturers installed and field installed wiring. Include the following:
    - a. System schematic
    - b. Point to point wiring diagram
    - c. Riser diagram

- d. Elevation of each door
  - 3. Detail interface between electrified door hardware and fire alarm, access control, security, and building control systems.
  - 4. Provide junction boxes, relays and terminal blocks as needed for proper door operations and connections.
- F. Upon door hardware submittal approval, furnish for each electrified opening, three copies of point to point diagrams.
- G. Closeout Submittals: Submit to Owner in a three ringed binder or CD if requested.
- 1. Warranties.
  - 2. Maintenance and operating manual.
  - 3. Maintenance service agreement.
  - 4. Record documents.
  - 5. Copy of approved hardware schedule.
  - 6. Copy of approved keying schedule with bitting list.
  - 7. Door hardware supplier name, phone number and fax number.

#### **1.04 QUALITY ASSURANCE**

- A. Listed and Labeled electrified door hardware as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction.
- B. Hardware supplier shall employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who shall be available at reasonable times during course of work for Project hardware consultation.
  - 1. Electrified Door Hardware Supplier Qualifications: Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in service performance.
- C. Door hardware conforming to ICC/ANSI A117.1. : Handles, Pulls, Latches, Locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
- D. Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and or labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.
- E. Fire Door Inspection: Prior to receiving certificate of occupancy have fire rated doors inspected by an independent certified Fire and Egress Door Assembly Inspector (FDAI), as certified by Intertek (ITS), a written report shall be submitted to Owner and Contractor. Doors failing inspection shall be adjusted, replaced or modified to be within appropriate code requirements.  
Use for buildings under IBC 2009
- F. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
- G. Door hardware certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.
- H. Substitution request: Include the reason for requesting the substitution, clear catalog copy highlighting the proposed product and options, compliance statement, technical data, product warranty and lead time, to show how the proposed can meet or exceed established level of design

function and quality. Approval of request is at the discretion of the owner, architect and their designated consultants.

- I. Pre-installation Meeting: Comply with requirements in Division 1 Section “Project Meetings.”
  - 1. Convene meeting seven days before installation. Participants required to attend: Contractor, installer, material supplier, manufacturer representatives, electrical contractor, security consultant and fire alarm consultant.
  - 2. Include in conference decisions regarding proper installation methods and procedures for receiving and handling hardware.
  - 3. Review sequence of operation for each type of electrified door hardware, inspect, and discuss electrical roughing-in and other preparatory work performed by other trades.
  - 4. Review and finalize construction schedule and verify availability of materials, installer’s personnel, equipment and facilities needed to make progress and avoid delays.
- I. Within fourteen days of receipt of approved door hardware submittals contact Owner with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock. Provide keying system per Owners instructions.
- J. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.
- K. Hardware listed in 3.07- Hardware Schedule is intended to establish type and grade.

#### **1.05 DELIVERY, STORAGE AND HANDLING**

- A. Provide clean, dry and secure room for hardware delivered to Project but not yet installed.
- B. Furnish hardware with each unit marked and numbered in accordance with approved finish hardware schedule. Include door and item number for each type of hardware.
- C. Pack each item complete with necessary parts and fasteners in manufacturer’s original packaging.
- D. Deliver permanent key, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to Owner shall be established at “Keying Conference.”
- E. Waste Management and Disposal: Separate waste materials for reuse or recycling in accordance with Division 1.

#### **1.06 WARRANTY**

- A. General Warranty: Owner may have under provisions of the Contract Documents and be an addition and run concurrent with other warranties made by Contractor under requirements of the Contract documents.
- B. Special Warranty: Warranties specified in this article shall not deprive Owner of other rights. .
  - 1. Ten years for manual door closers.
  - 2. Five years for mortise, auxiliary and bored locks.
  - 3. Five years for exit devices.
  - 4. One year for electromechanical door hardware.
- C. Replace or repair defective products during warranty period in accordance with manufacturer’s warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse and failure to exercise normal maintenance.

- D. Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, removal and replacement of door hardware.

## **PART 2 – PRODUCTS**

### **2.01 HINGES**

- A. Hinges, electric hinges of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Products to be certified and listed by the following:
1. Butts and Hinges: ANSI/BHMA A156.1
  2. Template Hinge Dimensions: ANSI/BHMA A156.7
- C. Butt Hinges:
1. Hinge weight and size unless otherwise indicated in hardware sets:
    - a. Doors up to 36" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .134" and a minimum of 4-1/2" in height.
    - b. Doors from 36" wide up to 42" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .145" and a minimum of 4-1/2" in height.
    - c. For doors from 42" wide up to 48" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
    - d. Doors greater than 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
    - e. Width of hinge is to be minimum required to clear surrounding trim.
  2. Base material unless otherwise indicated in hardware sets:
    - a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
    - b. Interior Doors: Steel material.
    - c. Fire Rated Doors: Steel or 304 Stainless Steel materials.
    - d. Stainless Steel ball bearing hinges to have stainless steel ball bearings. Steel ball bearings are unacceptable.
  3. Quantity of hinges per door unless otherwise stated in hardware sets:
    - a. Doors up to 60" in height provide 2 hinges.
    - b. Doors 60" up to 90" in height provide 3 hinges.
    - c. Doors 90" up to 120" in height provide 4 hinges.
    - d. Doors over 120" in height add 1 additional hinge per each additional 30" in height.
    - e. Dutch doors provide 4 hinges.
  4. Hinge design and options unless otherwise indicated in hardware sets:
    - a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
    - b. Out-swinging exterior and out-swinging access controlled doors shall have non-removable pins (NRP) to prevent removal of pin while door is in closed position.
    - c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
    - d. Electric Through Wire (ETW) to have appropriate number of wires to transfer power through door frame to door for proper connection of finish hardware and certified to handle an amperage rating of 3.5AMPS/continuous duty with 16.0AMPS/intermittent duty.
    - e. Provide mortar boxes for frames that require any electrically modified hinges if not an integral part of frame.
    - f. When shims are necessary to correct frame or door irregularities, provide metal shims only.

5. Acceptable Manufacturers:
- |                    |                 |                 |
|--------------------|-----------------|-----------------|
|                    | Standard Weight | Heavy Weight    |
| a. Hager Companies | BB1279/BB1191   | BB1168/BB1199   |
| b. Bommer          | BB5000/BB5002   | BB5004/BB5006   |
| c. McKinney        | TA2714/TA2314   | T4A3786/T4A3386 |

## 2.02 CONTINUOUS HINGES

- A. Continuous hinges of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Products to be certified and listed by the following: Continuous Hinges: ANSI/BHMA A156.26 Grade 1
- C. Continuous Geared Hinges:
1. Determine model number by door and frame application, door thickness, frequency of use, and fire rating requirements according to manufacturer's recommendations.
    - a. Length of hinge shall be 1" less door height unless otherwise stated in hardware sets.
- D. Material and Design:
1. Base material: Anodized aluminum manufactured from 6063-T6 material, unexposed working metal surfaces shall be coated with TFE dry lubricant
  2. Bearings:
    - a. Vertical loads shall be carried on Lubriloy RL bearings for non Fire Rated doors.
    - b. Continuous hinges shall have a minimum spacing between bearings of 2-9/16". Typical door from 80" to 84" in height to have a minimum of 32 bearings.
  3. Options:
    - a. Removable Electric Through-Wire (RETW) shall have appropriate number of wires to transfer power through door frame to door for proper connection of finish hardware. Provide RETW in a form that can be removed for connection, servicing without removing entire hinge from door and frame, and certified to handle an amperage rating of 3.5AMPS/continuous duty with 16.0AMPS/intermittent duty.
    - b. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
    - c. Fire rated hinges shall carry UL certification, up to and including 90-minute applications for wood doors and up to 3-hour applications for metal doors.
- E. Acceptable Manufacturers:
- |                    |            |
|--------------------|------------|
|                    | Heavy Duty |
| 1. Hager Companies | 780-224HD  |
| 2. Bommer          | FM120HD    |
| 3. Zero            | 914A       |

## 2.03 FLUSH BOLTS AND COORDINATORS

- A. Flushbolts of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer to be listed by the following: Auxiliary Hardware: ANSI/BHMA A156.16
- C. Labeled openings: Provide automatic or constant latching flush bolts per hardware schedule for inactive leaf of pairs of doors. Provide dust proof strikes for bottom bolt.
- D. Non-Labeled openings: Provide two flush bolts for inactive leaf of pairs of doors per hardware schedule. Top bolt shall not be more than 78" centerline from floor. Provide dust proof strike for bottom bolt.

E. Acceptable Manufacturers:	Manual Flush Bolt	Auto Flush Bolt	Dust Proof Strike
1. Hager Companies	282D	292D/295W/296W	280X
2. Rockwood	555	1942	570
3. Trimco	3917	3815	3911

F. Coordinators: Provide for labeled pairs of doors with automatic flush bolts or with vertical rod exit device with a mortise-locking device per hardware schedule. Provide filler piece to extend full width of stop on frame. Provide mounting brackets for closers and special preparation for latches where applicable.

G. Acceptable Manufacturers:	Coordinator	Bracket	Bracket for stops greater than 2-1/4"
1. Hager Companies	297	297M	297N
2. Rockwood	1600	1601AB	1601C
3. Trimco	3094	3095	3096

**2.04 REMOVABLE MULLIONS**

A. Keyed and non-keyed removable mullions of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following: UL/cUL/Warnock Hersey for fire rated pairs of doors up to 8 feet tall x 8 feet wide opening.

C. Material and Design:

1. For use with rim exit devices on non-rated and fire rated pairs of doors. Mullion 2"x 3"x 11 gage steel tube.
2. Top Fitting:
  - a. Mullion locked in place without use of a key.
  - b. Deadlock on fire rated device

D. Acceptable manufacturers for keyed removable mullions:

	Keyed Fire Rated	Keyed Non-Fire Rated
1. Hager Companies:	4900TF	4900T
2. Von Duprin:	KR9954	KR4954
3. Sargent:	12- L980	L980S

E. Acceptable manufacturers for removable mullions:

	Fire Rated	Non-Fire Rated
4. Hager Companies:	4900UF	4900U
5. Von Duprin:	9954	4954
6. Sargent:	12- 980	980S

**2.05 LOCKS AND LATCHES (GRADE 1 MORTISE)**

A. Locks and latches of one manufacturer as listed for continuity of design and consideration of warranty.

- B.
1. ANSI/BHMA A156.13 Series 1000 Certified to Grade 1 for Operational and Security.
  2. UL/cUL Labeled and listed up to 3 hours for single doors up to 48" in width and up to 96" in height.
  3. UL10C/UBC 7-2 Positive Pressure Rated.
  4. ICC/ANSI A117.1.

- C. Lock and latch function numbers and descriptions of manufactures series as listed in hardware sets.
- D. Material and Design:
  1. Lock cases from fully wrapped, 12 gauge steel, Zinc dichromate for corrosion resistance.
  2. Non-handed, field reversible without opening lock case.
  3. Break away spindles to prevent unlocking during forced entry or vandalism.
  4. Levers, Zinc cast, Forged Brass or Stainless Steel and plated to match finish designation in hardware sets.
  5. Sectional Roses, solid Brass or Stainless Steel material and have a minimum diameter of 2-7/16”.
  6. Escutcheons, of solid Brass or Stainless Steel material.
  7. Armor fronts, self-adjusting to accommodate a square edge door or a standard 1/8” beveled edge door.
- E. Latch and Strike:
  1. Stainless Steel latch bolt with minimum of 3/4” throw and deadlocking for keyed and exterior functions.
  2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4” x 4-7/8” with proper lip length to protect surrounding trim.
  3. Deadbolts to be 1-3/4” total length with a minimum of a 1” throw and 3/4” internal engagement when fully extended and made of Stainless Steel material.
- G. Electric Locks
  1. Fail Safe (power lock) Outside trim is locked when power is applied and unlocked when power is removed. Lockset will unlock in the event of a power failure. (EL)
  2. Fail Secure (power unlock) Outside trim is locked when there’s no power and unlocked when power is applied. Lockset will be locked in the event of a power failure. (EU)
  3. Latchbolt monitoring: Single switch SPDT mounted inside lockset monitors full extension of latchbolt. (LM)
  5. Door Position Monitor: Single switch SPDT Reed magnetic switch mounted inside lockset monitors whether door is fully closed. (DPM)
  6. Request to Exit: Monitors inside lever rotation. (RX)
- H. Acceptable Manufacturers:
  1. Schlage L9000 series x 06A lever design (No substitution)

## **2.06 MORTISE DEADBOLTS**

- A. Mortise deadbolts of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer to be certified by the following:
  1. ANSI/BHMA A156.13 Series 2000 Grade 1 Operational and Security
  2. UL/cUL listed for functions up to 3 hours for “A” label
  3. UL10C/UBC 7-2 Positive Pressure Rated
  4. ADA - Thumbturn
- C. Deadbolt function numbers and descriptions of manufactures series as listed in hardware sets.
- D. Material and Design:
  1. Latch bolt projection 1”throw
  2. Case steel, zinc dichromate
  3. Armor front 5-9/16”, case dimension 4-5/16” x 3-9/16” x 1”
- E. Acceptable Manufacturers:
  1. Schlage 400 Series (No substitution).

## **2.07 EXIT DEVICES (GRADE 1)**

- A. Exit Devices of one manufacturer as listed for continuity of design and consideration of warranty. Touch pad type, finish to match balance of door hardware
- B. Standards: Manufacturer to be certified and or listed by the following:
  - 1. BHMA Certified ANSI A156.3 Grade 1
  - 2. UL/cUL Listed for up to 3 hours for "A" labeled doors
  - 3. UL10C/UBC 7-2 Positive Pressure Rated
  - 4. UL10B Neutral Pressure Rated
  - 5. UL 305 Listed for Panic Hardware
- C. Material and Design:
  - 1. Touch pad shall extend a minimum of one half-door width. Freewheeling lever design shall match design of locks levers. Exit device to mount flush with door.
  - 2. Latchbolts:
    - a. Rim device – ¾" throw, Pullman type with automatic dead-latching, stainless steel
    - b. Surface vertical rod device – Top ½" throw, Pullman type with automatic dead-latching, stainless steel. Bottom ½" throw, Pullman type, held retracted during door swing, stainless steel.
  - 3. Fasteners: Wood screws, machine screws and thru-bolts.
- D. Lock and Latch Functions: Function numbers and descriptions of manufacturer's series and lever styles indicated in door hardware sets.
- E. Acceptable Manufacturers:
  - 1. Von Duprin: 98 Series/ 35A series (No substitution)
- F. Electric Modifications:
  - 1. Electric Latch Retraction: Continuous duty solenoids retract the latch bolt for momentary or maintained periods of time.
  - 2. Provide Request to Exit (REX) switches as scheduled.
  - 3. Electrified Trim: Outside trim locked (EL) or unlocked (EU) by electric current.
  - 4. Delayed Egress with Wall Mounted Controller (4501 DE)

## **2.08 CYLINDERS AND KEYING**

- A. Cylinders and cores of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer shall meet the following:
  - 1. Auxiliary Locks: ANSI/BHMA A156.5
  - 2. DHI Handbook "Keying systems and nomenclature" (1989)
- C. Cylinders:
  - 1. Match existing Cylinder housing and cores
  - 2. Furnish with cams/tailpieces as required for locking device that is being furnished for project.
- D. Keying:
  - 1. Conduct a keying meeting the owner's representative, to establish their requirements.
  - 2. Copy of Owners approved keying schedule submitted to Owner and Architect with documentation of which keying conference was held and Owners sign-off.
  - 3. Provide a bitting list to Owner of combinations as established, and expand to twenty five percent for future use or as directed by Owner.
  - 4. Key into Owner's existing interchangeable core keying system.
  - 5. Keys to be shipped to Owner's representative, individually tag per keying conference.

6. Provide visual key control identification on keys.
- E. Acceptable manufacturers:
  1. Schlage -No substitution

## **2.09 PUSH/PULL PLATES AND BARS**

- A. Push/Pull plates and bars of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer to be certified by the following:
  1. Architectural Door Trim: ANSI/BHMA A156.6
  2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- C. Push plates: .050" thick, square corner and beveled edges with counter sunk screw holes. Width and height as stated in hardware sets.
- D. Acceptable Manufacturers:
  1. Hager Companies: 30S
  2. Rockwood
  3. Trimco
- E. Pull plates: .050" thick, square corner and beveled edges. Width and height as stated in hardware sets, 3/4" diameter pull, with clearance of 2-1/2" from face of door.
- F. Acceptable Manufacturers:
  1. Hager Companies: H33J
  2. Rockwood
  3. Trimco
- G. Push Pull Bar Sets: 1" round bar stock with 2 1/2" clearances from face of door. Offset 3", 90-degree standard. Center to center size should be door width less 1 stile width.
- H. Acceptable Manufacturers:
  1. Hager Companies: H160D
  2. Rockwood
  3. Trimco

## **2.10 CLOSERS (CAST IRON BODY GRADE 1)**

- A. Closers of one manufacturer as listed for continuity of design and consideration of warranty. Unless otherwise indicated on hardware schedule, comply with manufacturer's recommendation for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirements, and fire rating.
- B. Standards: Manufacturer to be certified and or listed by the following:
  1. BHMA Certified ANSI A156.4 Grade 1
  2. ADA Compliant ANSI A117.1
  3. UL/cUL Listed up to 3 hours.
  4. UL10C Positive Pressure Rated
  5. UL10B Neutral Pressure Rated
- C. Material and Design:
  1. Provide cast iron non-handed bodies with full plastic covers.
  2. Closers shall have separate staked adjustable valve screws for latch speed, sweep speed, and backcheck.
  3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.

4. One-piece seamless steel spring tube sealed in hydraulic fluid.
  5. Double heat-treated steel tempered springs.
  6. Precision-machined heat-treated steel piston.
  7. Triple heat-treated steel spindle.
  8. Full rack and pinion operation.
- D. Mounting:
1. Out swing doors use surface parallel arm mount closers except where noted on hardware schedule.
  2. In swing doors use surface regular arm mount closers except where noted on hardware schedule.
  3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
  4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.
- E. Size closers in compliance with requirements for accessibility (ADDAG). Comply with following maximum opening force requirements.
1. Interior hinged openings: 5.0 lbs.
  2. Fire rated and exterior openings use minimum opening force allowable by authority having jurisdiction.
- F. Fasteners: Provide self-reaming and self-tapping wood and machine screws and sex nuts and bolts for each closer.
- G. Acceptable manufacturers:
1. LCN: 4000 Series (No substitution)

## **2.11 PROTECTIVE TRIM**

- A. Protective trim of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Size of protection plate: Single doors, size two inches less door width (LDW) on push side of door, and one inch less on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and ½ inch on pull side of door.
1. Kickplates 10" high or sized to door bottom rail height
- C. Standards: Manufacturer shall meet requirements for:
1. Architectural Door Trim: ANSI/BHMA A156.6
  2. UL
- D. Material and Design:
1. 0.050" gage stainless steel
  2. Corners square, polishing lines or dominant direction of surface pattern shall run across door width of plate.
  3. Bevel top, bottom and sides uniformly leaving no sharp edges.
  4. Provide countersink holes for screws for all protection plates. Screws holes shall be spaced equidistant eight inches CTC, along a centerline not over ½ inch in from edge around plate. End screws maximum of 0.53 inch from corners.
- E. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufactures UL listing for maximum height and width of protection plate to be used.
- F. Acceptable Manufacturers:
1. Hager Companies: 194S
  2. Trimco

3. Burns

**2.12 STOPS AND HOLDERS**

- A. Stops and holders of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible. Door stops and holders mounted in concrete floor or masonry walls have stainless steel machine screws and lead expansion shields.
- C. Standards: Manufacturer shall meet requirements for:
  - 1. Auxiliary Hardware: ANSI/BHMA A156.16
- D. Acceptable Manufacturers:

	Convex	Concave
1. Hager Companies	232W	236W
2. Rockwood		
3. Burns		
- E. Overhead Stops and Holders: Provide overhead stop and holders for doors that open against equipment, casework sidelights and other objects that would make wall stops/holders and floor stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.
- F. Standards: Manufacturer shall be certified by the following:
  - 1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1
- G. Acceptable Manufacturers:

	Heavy Duty Surface	Heavy Duty Concealed
1. Hager Companies	7000 SRF Series	7000 CON Series
2. Glynn Johnson	90 Series	100 Series
3. Sargent	590 Series	

**2.13 ELECTROMAGNETIC HOLDERS**

- A. Electromagnetic holders of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer shall meet requirements for:
  - 1. ANSI 156.15 Grade 1
  - 2. UL/ULC listed
  - 3. California State Fire Marshall listed (CSFM)
  - 4. City of New York MEA approved
- C. Material and Design:
  - 1. Provide electromagnetic holders where self-closing fire doors and smoke barrier doors are required to be held open. Electromagnetic holders to be fail safe, when electrical current is interrupted, doors release to close automatically. Holding force 25-40 pounds.
- D. Acceptable Manufacturers:
  - 1. Hager Companies: 380 Series
  - 2. LCN
  - 3. Rixson

**2.14 POWER SUPPLY (for fail safe or fail secure locking devices )**

- A. Power supplies of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer shall meet requirements for:
  - 1. UL Listed
- C. Design:
  - 1. Interface with building alarm controls, card readers, keypads, and other door controls.
  - 2. Filtered and regulated 24 VDC constant voltage
  - 3. 2 AMP load capacity
  - 4. Over voltage/short circuit protection
  - 5. Surge protection for locking devices
  - 6. Interface relay
  - 7. Adjustable time delay
- D. Acceptable Manufacturer:
  - 1. Hager Companies 2903

**2.15 DOOR GASKETING AND WEATHERSTRIP**

- A. Door gasketing and weather-strip of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide non-corrosive fasteners for exterior applications.
  - 1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.
  - 2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
  - 3. Door bottoms: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
  - 4. Sound Gasketing: Cutting or notching for stop mounted hardware not permitted.
  - 5. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4” beyond width of door.
- C. Standards: Manufacturer shall meet requirements for:
  - 1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22
  - 2. BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing. (721)
- D. Smoke-Labeled Gasketing: Comply with NFPA 105 listed, labeled, and acceptable to authorities having jurisdiction, for smoke control indicated.
  - 1. Provide smoke labeled gasketing on 20 minute rated doors and on smoke rated doors.
- E. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.
- F. Refer to Section 08 1416 Wood Doors for Category A or Category B. Comply with UBC 7-2 and UL10C positive pressure where frame applied intumescent seals are required. Provide Hager # 720 for single and 720 x 724 for a pair of doors.
- G. Acceptable Manufacturers:
  - 1. Perimeter Gasketing:
 

	Adhesive Applied	Stop Applied
a. Hager Companies:	726	881S
b. K.N. Crowder:		

- c. Reese:
- 2. Sound Seal:
  - a. Hager Companies: 726 - 864S
  - b. K.N. Crowder:
  - c. Reese:
- 2. Meeting Stile Weatherstrip:
  - a. Hager Companies: 872SN
  - b. K.N. Crowder:
  - c. Reese:
- 3. Door Bottom Sweeps:
  - a. Hager Companies: 770S V
  - b. K.N. Crowder:
  - c. Reese:
- 4. Overhead Drip Guard
  - a. Hager Companies: 810S
  - b. K.N. Crowder:
  - c. Reese:

**2.16 THRESHOLDS**

- A. Thresholds of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Set thresholds for exterior and acoustical openings in full bed of sealant with lead expansion shields and stainless steel machine screws complying with requirements specified in Division 7 Section "Joint Sealants". Notched in field to fit frame by hardware installer. Refer to Drawings for special details.
- C. Standards: Manufacturer to be certified by the following:
  - 1. Thresholds: ANSI/BHMA A156.21
  - 2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- D. Acceptable Manufacturers:
  - 1. Hager Companies: 412S
  - 2. K.N. Crowder
  - 3. Reese

**2.17 SLIDING DOOR HARDWARE**

- A. Sliding door hardware of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Sliding Door Hardware: Provide complete sets of rails, hangers, supports, bumpers, floor guides, and accessories indicated.
- C. Standards: Manufacturer conforms to:
  - 1. Sliding Door Hardware: ANSI/BHMA A156.14
- D. Bypassing Sliding Door Hardware: Rated for doors weighing up to 150 lbs.
- E. Pocket Sliding Door Hardware: Rated for doors weighing up to 250 lbs.
  - 1. Provide Pocket door kit for pocket doors. Kits are to include header assembly, split studs, hangers, door hanger plates, bumper, guides, floor plate, and end bracket.

F. Wall Mounted Fascia: Rated for doors weighting up to 250 lbs.

G. Acceptable Manufacturers:

	By-Pass	Pocket Door Kits	Wall Mounted
1. Hager Companies	9603	9850	9710
2. Lawrence			
3. K.N. Crowder			

## 2.59 SILENCERS

A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.

B. Standards: Manufacturer shall meet requirements for:

1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufacturers:

	Hollow Metal Frame	Wood Frame
1. Hager Companies:	307D	308D
2. Rockwood:		
3. Trimco:		

## 2.60 PRIVACY SCREEN

A. Where indicated in hardware sets, provide privacy screens to fit over door lites to afford visual black out in the event of a lock-down.

B. Ensure privacy screens are sized to the door lites for complete black out per manufacturers instructions.

C. Acceptable Manufacturer:

1. Air Louvers - Activar "VELO Privacy Screen" PS Series

## 2.61 FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples.

B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

## PART 3 – EXECUTION

### 3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install hardware per manufacturer's instructions and in compliance with:
  - 1. NFPA 80.
  - 2. NFPA 105.
  - 3. ICC/ANSI A117.1.
  - 4. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames
  - 5. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames
  - 6. DHI Publication – Installation Guide for Doors and Hardware
  - 7. UL10C/UBC7-2
  - 8. Local building code.
  - 9. Approved shop drawings.
  - 10. Approved finish hardware schedule.
- B. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

### **3.03 FIELD QUALITY CONTROL**

- A. Material supplier to schedule final walk through to inspect hardware installation ten business days before final acceptance of Owner. Material supplier shall provide a written report detailing discrepancies of each opening to General Contractor within seven calendar days of walk through.

### **3.04 ADJUSTMENT, CLEANING AND DEMONSTRATING**

- A. Adjustment: Adjust and check each opening to ensure proper operation of each item of finish hardware. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.
- B. Cleaning: Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no cost to Owner.
- C. Demonstration: Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finished hardware to be turned over and explained usage at this meeting.

### **3.05 PROTECTION**

- A. Leave manufacturer's protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacture until Owner accepts Project as complete.

### **3.06 HARDWARE SET SCHEDULE**

- A. Guide: Door hardware items have been placed in sets which are intended to be a guide of design, grade, quality, function, operation, performance, exposure, and like characteristics of door hardware, and may not be complete. Provide door hardware required to make each set complete and operational.
- B. Hardware schedule does not reflect handing, backset, method of fastening and like characteristics of door hardware and door operation.
- C. Review door hardware sets with door types, frames, sizes and details on drawings. Verify suitability and adaptability of items specified in relation to details and surrounding conditions.

### 3.07 HARDWARE SCHEDULE

#### Set #1 Classrooms – Swing to wall at 90 degrees

Door Numbers: B203, B203C, B213, C201, C212, D201, D202, D203, D204, D205, D206, D208, D210, D211, D212, D213, D214, D215, D216, D217

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D SCH
2 ea.	Core	Match Existing System	US26D SCH
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Floor Stop/Holder	327W	US26D HAG
1 ea.	Gasket	By kerf'ed frame manufacturer	- -
1 ea.	Privacy Screen for door lites	PS series, sized for door lites	TBD AL

#### Set #2 Classrooms – Swing to wall at 90 degrees

Door Numbers: C202

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D SCH
2 ea.	Core	Match Existing System	US26D SCH
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Floor Stop/Holder	327W	US26D HAG
1 ea.	Gasket	726 head and jambs	Char HAG
1 ea.	Privacy Screen for door lites	PS series, sized for door lites	TBD AL

#### Set #3 Classrooms with OH holder

Door Numbers: B105, C204, C208, C209, C210, C211, C213, C214, C215

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D SCH
2 ea.	Core	Match Existing System	US26D SCH
1 ea.	O.H. Holder	7017 SRF	US26D HAG
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Gasket	By kerf'ed frame manufacturer	- -
1 ea.	Privacy Screen for door lites	PS series, sized for door lites	TBD AL

#### Set #4 Faculty Work Room with closer

Door Numbers: D207

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D SCH
2 ea.	Core	Match Existing System	US26D SCH
1 ea.	Closer	4000 S-CUSH	ALM LCN
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Gasket	726 head and jambs	Char HAG

1 ea. Privacy Screen for door lites PS series, sized for door lites TBD AL  
 For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #5 Offices, In-Swing

Door Numbers: C200A, C200AB, C200B, C200E

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D SCH
2 ea.	Core	Match Existing System	US26D SCH
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Wall Stop	236W	US32D HAG
1 ea.	Gasket	726 head and jambs	Char HAG
1 ea.	Privacy Screen for door lites	PS series, sized for door lites Door #'s C200A, C200E	TBD AL

For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #6 Offices, In-Swing

Door Numbers: C200C

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D SCH
2 ea.	Core	Match Existing System	US26D SCH
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Wall Stop	236W	US32D HAG
1 ea.	Gasket	By kerf'ed frame manufacturer	- -

Set #7 Offices with closer

Door Numbers: A108A, B105AA, B105AB, B107, B109

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D SCH
2 ea.	Core	Match Existing System	US26D SCH
1 ea.	Closer	4000	ALM LCN
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Wall Stop	236W (were applicable)	US32D HAG
1 ea.	Gasket	By kerf'ed frame manufacturer	- -
1 ea.	Privacy Screen for door lites	PS series, sized for door lites Door #'s B105AA, B107, B109	TBD AL

Set #8 Offices with closer

Door Numbers: A101A

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D SCH
2 ea.	Core	Match Existing System	US26D SCH

1 ea.	Closer	4000 (180 degree swing)	ALM	LCN
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D	HAG
1 ea.	Floor Stop	242F	US26D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #9 Single Use Toilets

Door Numbers: B217, B218  
Each opening to receive:

Qty.	Type	Description	Finish	
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D	HAG
1 ea.	Privacy Lock, with indicator	L9496 06A	US26D	SCH
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #10 All glass sliding doors

Door Numbers: C200G, C200H  
Each opening to receive:

Qty.	Type	Description	Finish
All hardware by sliding glass door manufacturer as part of the assembly.			

Set #11 Storage – Out Swing

Door Numbers: A104, B112, C110, B203B, B215, B216, C205, C206, D209  
Each opening to receive:

Qty.	Type	Description	Finish	
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D	HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D	HAG
1 ea.	Core	Match Existing System	US26D	-
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D	HAG
1 ea.	O.H. Holder	7016 SRF	US26D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #12 Storage – Out Swing

Door Numbers: A112  
Each opening to receive:

Qty.	Type	Description	Finish	
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D	HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D	HAG
1 ea.	Core	Match Existing System	US26D	-
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D	HAG
1 ea.	O.H. Holder	7016 SRF	US26D	HAG
1 ea.	Gasket	By kerf'ed frame manufacturer	-	-

Set #13 Storage – In Swing

Door Numbers: A105, B203A, B113A, C109A, C200D, C200F  
 Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D HAG
1 ea.	Core	Match Existing System	US26D -
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Wall Stop	236W	US32D HAG
1 ea.	Gasket	726 head and jambs	Char HAG

For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #14 Closet - Pair

Door Numbers: A101F  
 Each opening to receive:

Qty.	Type	Description	Finish
2 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 set	Auto Flush Bolt	296W	US26D HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D SCH
1 ea.	Core	Match Existing System	US26D SCH
2 ea.	Door Stop & Holder	328F	US26D HAG
1 ea.	Gasket	By kerf'ed frame manufacturer	- -

Set #15 Interior Auditorium entrance – Pair

Door Numbers: A101B, A101C, A101G, A102, A107, A108, CR100, CR100B  
 Each opening to receive:

Qty.	Type	Description	Finish
2 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	SVR Panic	9927EO LBR Inactive leaf)	US26D VD
1 ea.	Mortise Panic Device	9975-L-06 (active leaf)	US26D VD
1 ea.	Open Back Strike	576A OBS	US26d VD
1 ea.	Mortise Cylinder & Core	Match Existing System	US26D SCH
2 ea.	Closer	4111 HCUSH	ALM HAG
2 ea.	Kick Plate	190S 10" x 1" LDW	US32D HAG
1 ea.	Threshold	412S door width	MIL HAG
1 ea.	Gasket	726 head and jambs	Char HAG
1 set	Astragal Weather-strip	872S N (2x) door height	CLR HAG
2 ea.	Auto Door Bottom	730S N door width	MIL HAG
2 ea.	Privacy Screen for door lites	PS series, sized for door lites	TBD AL

For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #16 Exterior Auditorium – Pair

Door Numbers: A101H, A102A, A110  
 Each opening to receive:

Qty.	Type	Description	Finish
2 ea.	Continuous Hinges	780-224HD	Clear HAG
1 ea.	SVR Panic	9927EO LBR Inactive leaf)	US26D VD
1 ea.	Mortise Panic Device	9975-L-06 (active leaf)	US26D VD
1 ea.	Open Back Strike	576A OBS	US26D VD

1 ea.	Mortise Cylinder & Core	Match Existing System	US26D	SCH
2 ea.	Closer	4111 HCUSH	ALM	HAG
2 ea.	Kick Plate	190S 10" x 1" LDW	US32D	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
1 set	Astragal Weather-strip	872S N (2x) door height	CLR	HAG
2 ea.	Auto Door Bottom	742S N door width	MIL	HAG

For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #17 Stairs – Pair – Fire Rated

Door Numbers: S201, S202, S203, S204, CR204, S205

Each opening to receive:

Qty.	Type	Description	Finish	
2 ea.	Continuous Hinges	780-224HD UL-FF	Clear	HAG
1 ea.	SVR Fire Exit Device	9927-F EO LBR (inactive leaf) w/ Fire Bolt	US26D	VD
1 ea.	SVR Fire Exit Device	9927-F-LBE-06 LBR (active leaf)	US26D	VD
2 ea.	Closer	4000	ALM	HAG
2 ea.	Kick Plate	190S 10" x 1" LDW	US32D	HAG
2 ea.	Magnetic Holders	380 Series	ALM	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
1 set	Astragal Weather-strip	872S N (2x) door height	CLR	HAG
1 ea.	Power Supply	2908	-	HAG

Description of Operation: Doors normally held open with magnetic holders that are to be connected to the fire alarm. In the event of alarm activation, the doors shall release allowing the mechanical hardware to provide fire protection. If available and workable, reuse the existing magnetic holders.

Set #18 Pair Alum Exterior Non- Rated with Card Reader

Door # A100A

Each opening to receive:

Qty	Type	Description	Finish	
1 ea.	Continuous Hinge	780-224 HD	Clear	HAG
1 ea.	Electrified Continuous Hinge	780-224 HD RETW	Clear	HAG
1 ea.	CVR Panic Device	CD3347A-EO (inactive leaf)	US26D	VD
1 ea.	CVR Panic Device MLR	3347A QEL NL-OP	US26D	VD
2 ea.	Mortise Cylinder & Core	Match Existing System (for CD)	US26D	SCH
1 ea.	Rim Cylinder & Core	Match Existing System (for NL)	US26D	SCH
2 ea.	Off-set Pulls	11J	US32D	HAG
2 ea.	Closer w/hold open	4111 HCUSH	ALUM	LCN
2 ea.	Drop Plate	5110 (as required)	ALUM	HAG
2 ea.	Blade Stop Spacer	5113 (as required)	ALUM	HAG
1 ea.	Threshold	412S	MIL	HAG
1 ea.	Power Supply	PS900 Series	-	VD

Weather-strip and sweeps by door manufacturer.

120VAC power, conduit and wiring by Division 26.

Card Reader by Division 28.

Description of Operation: Door normally closed and locked. Key retracts latch. Removing key leaves door locked. Access upon proper credential validation at the card reader. In the event of a power failure the device remains locked (fail secure). Free egress at all times

Set #19 Media Center entrance – Pair – Non- Rated

Door # C200

Each opening to receive:

Qty	Type	Description	Finish
2 ea.	Continuous Hinge	780-224 HD	Clear HAG
1 ea.	SVR Panic Device	CD3327A LBR -EO (inactive)	US26D VD
1 ea.	SVR Panic Device	CD3327A LBR NL-OP (active)	US26D VD
1 ea.	Rim Cylinder & Core	Match Existing System (for NL)	US26D SCH
2 ea.	Mortise Cylinder & Core	Match Existing System (for CD)	US26D SCH
2 ea.	Off-set Pulls	11J	US32D HAG
2 ea.	Closer w/hold open	4111 HCUSH	ALUM LCN
2 ea.	Drop Plate	(as required)	ALUM LCN
4 ea.	Privacy Screen for door lites	PS series, sized for door lites	TBD AL

Description of Operation: Door normally closed and locked. Key retracts latch. Removing key leaves door locked. Key can be used with cylinder dogging to allow for push and pull operation. Free egress at all times.

Set #20 Pair Alum Vestibule Non- Rated

Door # CR100A

Each opening to receive:

Qty	Type	Description	Finish
2 ea.	Cont. Hinge	780-224HD	Clear HAG
2 ea.	Push/Pull Bars	157V	US32D HAG
		Center push bar in door stiles	
2 ea.	Closer w/hold open	4111 CUSH	ALUM LCN
2 ea.	Drop Plate	5110 (as required)	ALUM HAG
2 ea.	Blade Stop Spacer	5113 (as required)	ALUM HAG
1 ea.	Threshold	412S door opening width	MIL HAG

Weather-strip and sweeps by door manufacturer.

Set #21 Multi-use Toilets

Door Numbers: A103, A106

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG
1 ea.	Aux Mortise Classroom Dead-bolt	L463R	US26D SCH
1 ea.	Core	Match Existing System	US26D SCH
1 ea.	Push Plate	30S 4" x 16"	US32D HAG
1 ea.	Pull Plate	33E 4" x 16"	US32D HAG
1 ea.	Closer	4000	ALM LCN
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D HAG
1 ea.	Wall Stop	236W	US32D HAG
3 ea.	Silencers	307D	Gray HAG

For existing frames to remain, fill all existing hinge preparations and make invisible.

Set #22 Sgl Media Room Exit

Door Numbers: C200J

Each opening to receive:

Qty.	Type	Description	Finish
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D HAG

1 ea.	Panic Device	CD99L-NL-06	US26D	VD
1 ea.	Rim Cylinder & Core	Match Existing System (NL)	US26D	SCH
1 ea.	Mortise Cylinder & Core	Match Existing System (CD)	US26D	SCH
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Gasket	By kerf'ed frame manufacturer	-	-

Set #23 Sgl Media Room Exit - Alarmed

Door Numbers: C200K  
Each opening to receive:

Qty.	Type	Description	Finish	
1 ea.	Continuous Pin-Barrel Hinge	790-900	US32D	HAG
1 ea.	Alarmed Panic Device	99L-NL-06 ALK	US26D	VD
1 ea.	Rim Cylinder & Core	Match Existing System (NL)	US26D	SCH
1 ea.	Mortise Cylinder & Core	Match Existing System (ALK)	US26D	SCH
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10" x 2" LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
1 ea.	Gasket	By kerf'ed frame manufacturer	-	-

Set #24 Existing doors

Door Numbers: B105A, B105B, B107A, B107B, B201A, B201B, B201C, B201D, B205A, B205B, B207A, B207B, B213A, C201A, C201B, C202A, C204A, C208A, C208B, C209A, C209B, C210A, C210B, C212A, C212B, C213A, C213B, C214A, C214B, C215A, C215B, D201A, D201B, D202A, D202B, D203A, D203B, D204A, D204B, D205A, D205B, D206A, D206B, D208A, D208B, D210A, D210B, D211A, D211B, D212A, D212B, D213A, D213B, D214A, D214B, D215A, D215B, D216A, D216B, D217A, D217B

Each opening to receive:

Qty.	Type	Description	Finish	
All existing hardware to remain. Repair or replace any hardware that does not function properly.				

Set #25 Roll-up Door

Door Numbers: A101AA  
Each opening to receive:

Qty.	Type	Description	Finish	
All hardware by Roll-up Door manufacturer				

Set #26 – Cased Open

Door Numbers: A101AB, B103A, B103B, B111, B113, C109, C111, B209, B211, C203, C207  
Each opening to receive:

Qty.	Type	Description	Finish	
No Hardware required				

**END OF SECTION**

## SECTION 09 0561

### COMMON WORK RESULTS FOR FLOORING PREPARATION

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
  - 1. Rubber tile.
  - 2. Broadloom carpet.
  - 3. Carpet tile.
  - 4. Thin-set ceramic tile and stone tile.
  - 5. Luxury Vinyl Tile.
- B. Removal of existing floor coverings.
- C. Preparation of existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (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.
- F. Patching compound.
- G. Remedial floor coatings.

##### 1.02 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.
- E. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

##### 1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

##### 1.04 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.

- C. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.
  - 5. Recommendations for remediation of unsatisfactory surfaces.
  - 6. Submit report to Architect.
  - 7. Submit report not more than two business days after conclusion of testing.
- D. Copy of RFCI (RWP).
- E. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
  - 1. Manufacturer's installation instructions.
  - 2. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

#### 1.05 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. 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.
- D. 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 Architect when specified ambient conditions have been achieved and when testing will start.
- E. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

#### 1.07 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 (18 degrees C) or more than 85 degrees F (30 degrees C).

- 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. 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 alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

## **PART 3 EXECUTION**

### **3.01 CONCRETE SLAB PREPARATION**

- A. Perform following operations in the order indicated:
  - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
    - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    - b. Removal of existing floor covering.
  - 2. Preliminary cleaning.
  - 3. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
  - 4. Alkalinity (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 or remedial sheet membrane over entire suspect floor area.

3. Excessive Alkalinity (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 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

### 3.03 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.

### 3.04 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 (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

### 3.05 ALKALINITY 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. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
- C. Use a wide range alkalinity (pH) test 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 (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (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 alkalinity (pH) 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.

**END OF SECTION**

**SECTION 09 2116**  
**GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Gypsum sheathing.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- C. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire rated walls.
- D. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014, with Editorial Revision (2015).
- D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2017.
- E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2017a.
- F. 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; 2015.
- G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2016.
- H. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.
- I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- J. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.
- K. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2013a.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

- M. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2018.
- N. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.
- O. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- Q. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- R. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.
- S. UL (FRD) - Fire Resistance Directory; current edition.

#### 1.04 SUBMITTALS

- A. See Section 01 3000 - 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 stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

#### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing.

### **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.
- B. Interior Partitions: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
  - 1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

#### 2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
  - 1. Clarkwestern Dietrich Building Systems LLC; \_\_\_\_: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  - 2. Marino; \_\_\_\_: [www.marinoware.com/#sle](http://www.marinoware.com/#sle).
  - 3. Phillips Manufacturing Co; \_\_\_\_: [www.phillipsmfg.com/#sle](http://www.phillipsmfg.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- 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/120 at 5 psf (L/120 at 240 Pa).
  - 1. Studs: "C" shaped with flat or formed webs with knurled faces.

2. Runners: U shaped, sized to match studs.
  3. Ceiling Channels: C-shaped.
  4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
- C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
- D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- E. 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 fastened as indicated on drawings.

### 2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
1. CertainTeed Corporation; \_\_\_\_: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  2. Georgia-Pacific Gypsum; \_\_\_\_: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  3. National Gypsum Company; \_\_\_\_: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
  4. USG Corporation; \_\_\_\_: [www.usg.com/#sle](http://www.usg.com/#sle).
  5. Substitutions: See Section 01 6000 - 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 (16 mm).
    - b. Ceilings: 5/8 inch (16 mm).
- C. Abuse Resistant Wallboard:
1. Application: at all gypsum board partitions, 9 feet and below.
  2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
  3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  4. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
  5. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M.
  6. Type: Fire resistance rated Type X, UL or WH listed.
  7. Thickness: 5/8 inch (16 mm).
  8. Edges: Tapered.
  9. Products:
    - a. National Gypsum Company; Gold Bond Hi-Abuse XP Gypsum Board.
    - b. Substitutions: See Section 01 6000 - 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. 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. Type: Regular and Type X, in locations indicated.
  5. Type X Thickness: 5/8 inch (16 mm).
  6. Edges: Tapered.
  7. Products:
    - a. Georgia-Pacific Gypsum; DensArmor Plus.
    - b. National Gypsum Company; Gold Bond XP Gypsum Board.
    - c. USG; Fiberock Aqua-Tough Interior Panel.
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
  4. Core Type: Type X, as indicated.
  5. Type X Thickness: 5/8 inch (16 mm).
  6. Edges: Square.
  7. Glass Mat Faced Products:
    - a. Georgia-Pacific Gypsum; DensGlass Sheathing.
    - b. National Gypsum Company; Gold Bond eXP Sheathing.
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- F. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

#### 2.04 ACCESSORIES

- A. Acoustic Insulation: As specified in Section 07 2100.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Water-Resistive Barrier: As specified in Section 07 2500.
- D. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
  1. Types: As detailed or required for finished appearance.
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
  1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
  2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
  3. Chemical hardening type compound.
- F. High Build Drywall Surfer: 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.
  1. Products:
    - a. USG Sheetrock Brand Tuff-Hide Primer-Surfer.
    - b. Substitutions: See Section 01 6000 - Product Requirements.

- G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.
- I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

#### **3.02 SHAFT WALL INSTALLATION**

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
  - 1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.
- B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
  - 1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
  - 2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

#### **3.03 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.
- C. Studs: Space studs at 16 inches on center (at 406 mm on center).
  - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
  - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
  - 3. 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.
- E. Blocking: Install wood blocking for support of:
  - 1. Framed openings.
  - 2. Wall mounted cabinets.
  - 3. Plumbing fixtures.
  - 4. Toilet partitions.
  - 5. Toilet accessories.
  - 6. Wall mounted door hardware.
  - 7. Handrails and wall brackets.
  - 8. Markerboards, tack boards

#### **3.04 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Place two beads continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.
  - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

### 3.05 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
  - 1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- G. Installation on Metal Framing: Use screws for attachment of gypsum board.

### 3.06 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

### 3.07 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 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- 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 (0.8 mm).
- 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 3000

### TILING

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Stone thresholds.
- D. Trim.

##### 1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete
- B. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- C. Section 07 9005 - Joint Sealers.
- D. Section 09 0561 - Common Work Results for Flooring Preparation
- E. Section 09 2116 - Gypsum Board Assemblies: Installation of tile backer board.

##### 1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2013.1.
  - 1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
  - 2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
  - 3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
  - 4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
  - 5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
  - 6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
  - 7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
  - 8. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
  - 9. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
  - 10. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

11. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
  12. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
  13. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
  14. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- B. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.
1. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles; 2014a.
- C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

#### 1.04 SUBMITTALS

- A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- C. Samples: Provide (2) samples of tile, coordinating trim peices, and grout. Tile samples to be full size.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

#### 1.06 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

### **PART 2 PRODUCTS**

#### 2.01 TILE

- A. Porcelain Tile, Type PFT-1: ANSI A137.1, standard grade.
  1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  2. Size: 12" by 24" inch (304 by 609 mm) nominal.
  3. Thickness: 3/8 inch (9.5 mm).
  4. Edges: Square.
  5. Surface Finish: Natural.
  6. Color(s): As indicated on drawings.
  7. Products: Basis of Design: Garden State Tile
    - a. Re\_Micron.
- B. Ceramic Wall Tile, Type CWT-1, CWT-2, CWT-3: ANSI A137.1, and as follows:
  1. Moisture Absorption: Over 7.0 but less than 20.0 percent.

2. Size and Shape: 6 inch (150 mm) square.
3. Color(s): As scheduled.
4. Trim Units: Matching surface bullnose, cove, and base shapes in sizes coordinated with field tile.
5. Product: Basis of Design: American Olean
  - a. Bright & Matte

## 2.02 TRIM AND ACCESSORIES

- A. Ceramic Trim: Matching cove base ceramic shapes in sizes coordinated with field tile.
  1. Applications:
    - a. Floor to Wall Joints: Cove base.
  2. Manufacturers: Same as for tile.
- B. Thresholds: Marble, white, or gray, honed finish; width as shown by full width of wall or frame opening; 3/4 inch thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.

## 2.03 SETTING MATERIALS

- A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
  1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
  2. Products: Basis of Design: Custom Building Products
    - a. Custom Building Products; Megalite: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.

## 2.04 GROUTS

- A. Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
  1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
  3. Color(s): As selected by Architect from manufacturer's full line.
  4. Products:
    - a. Custom Building Products; Prism Color Consistent Grout: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Grout Sealant: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
  1. Products
    - a. Bonsal American, Inc.: Grout Sealer.
    - b. Bostik: CeramaSeal Grout Sealer.
    - c. C-Cure: Penetrating Sealer 978.
    - d. MAPEI Corporation: KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
    - e. Summitville Tiles, Inc.: SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
    - f. TEC Specialty Products, Inc.; TA-256 Penetrating Silicone Grout Sealer.

## 2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
  1. Applications: Between tile and plumbing fixtures.

2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
  - a. Custom Building Products; Commercial 100% Silicone Caulk:  
[www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  - b. Approved equal product.

### **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 tile.
  1. Refer to Section 09 0561.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

#### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

#### **3.03 INSTALLATION - GENERAL**

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated as shown on drawings. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Sound tile after setting. Replace hollow sounding units.
- G. Keep control and expansion joints free of mortar, grout, and adhesive.
- H. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

### 3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
  - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
    - a. Locations: Toilet rooms with floor drains.

### 3.05 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

### 3.06 GROUTING

- A. Follow grout manufacturer's recommendations as to grouting procedures and precautions.
- B. Remove all grout haze, observing both tile and group manufacturer's recommendations as to use of acid and chemical cleaners.
- C. Rinse tile work thoroughly with clean water before and after chemical cleaners.
- D. Polish surface of tile work with soft cloth.
- E. Seal finished grout lines with sealer, applied following directions by the manufacturer.

### 3.07 CLEANING

- A. Clean tile and grout surfaces.

### 3.08 PROTECTION

- A. Apply a protective coat of neutral cleaner solution, 1 part cleaner to 1 part water, or as specified by manufacturer's instructions, to completed tile floors.
- B. Cover all tile floors with heavy-duty, non-staining construction paper, taped in place.
- C. Prior to final acceptance of tile work, remove paper and rinse protective coat of neutral cleaner from all tile surfaces.
- D. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**

**SECTION 21 0170**  
**FIRE SUPPRESSION SPRINKLER SYSTEMS**

**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.
- B. Codes and Standards listed below, apply to work indicated on the drawings and in the specifications.
  - 1. National Fire Protection Association (NFPA)
  - 2. Delaware State Fire Prevention Regulations (DSFPR)
  - 3. American National Standards Institute (ANSI)
  - 4. American Society for Testing Materials (ASTM)
  - 5. National Electrical Manufacturer's Association (NEMA)
  - 6. Underwriters' Laboratories (UL)

**1.2 SUMMARY**

- A. This Section includes fire-suppression sprinklers, piping, and equipment for the following building systems:
  - 1. Wet-pipe, fire-suppression sprinkler systems, including piping, valves, specialties and automatic sprinklers.
  - 2. Contractor shall provide schedule and location of all fire hose valve cabinets on sprinkler drawings regardless of which trade procures or installs them.
- B. Additional work includes, but is not limited to the following:
  - 1. Obtain and pay for all permits, licenses, approvals, reviews, utility shutdowns, water flow testing, pressure tests and acceptance inspections.
  - 2. Pipe sleeves through floors, walls and structural elements of the building, set in coordinated locations. Penetrations created in fire rated walls and floors, shall have their smoke stopping and fire rating integrity restored with the use of fire tested, U.L. listed details, that have prior approval of the local Fire Prevention Bureau.
  - 3. All cutting, coring and patching of general construction as necessary for installation of the work specified.
  - 4. Coordinated working drawings and hydraulic calculations from water flow test data less than one year old; submit and obtain approval by the local Fire Prevention Bureau and Owner's Insurance Underwriter, and State Fire Marshal.
  - 5. Clean-up, on a daily basis, of all debris associated with the installation of this work, as necessary to maintain the premises in a broom swept condition.
  - 6. Testing, adjusting, retesting, re-adjusting as may be required to obtain system acceptance by the local Fire Prevention Bureau, Owner's Insurance Underwriter, State Fire Marshal and Owner's Representative. Fire Protection Contractor shall remain responsible for the fire protection systems until all approvals are obtained.
  - 7. Provide equipment manuals, record drawings, valve tag schedules and personnel instruction, prior to system turnover to the Owner.
  - 8. Provide fire protection on all floors during construction, utilizing temporary standpipes or fire extinguishers, according to the requirements of the authority having jurisdiction.

9. Performance of all work specified in this Section shall be in compliance with the requirements of the Occupational Safety and Health Act and Construction Safety Standards.
- C. The work in this Section includes providing all labor, materials, specialty products testing and services for, and reasonably incidental to, the satisfactory completion of the Fire Protection systems, as indicated on the Contract Drawings, in the Specification Sections, and as required by the applicable Codes and Standards.
- D. The following related work is specified in other Divisions and Sections of the specification.
  1. Fire extinguishers and cabinets.
- E. Related Sections include the following:
  1. Division 22 Section "General Provisions – Plumbing/Fire Protection
  2. Division 10 Section "Fire Protection Specialties" for cabinets and fire extinguishers.
  3. Division 7 Section "Fire Stopping"

### 1.3 DEFINITIONS AND INTERPERTATIONS

- A. Specific terminology used in the Design Drawings and Specifications shall have the following meanings;
  1. "Piping" includes pipe, fittings, flanges, valves, controls, hangers, supports, vents, drains and other customarily required items required in connection with the transfer of gases and fluids.
  2. "Install" includes unloading at the delivery point for the project and performing all tasks necessary to establish a secure mounting and correct operation, for items and assemblies furnished by other trades or the Owner.
  3. "Furnish" includes purchase and delivery to the project site, of items and assemblies, complete with every necessary appurtenance.
  4. "Provide" shall mean "Furnish and Install"
  5. "Concealed" when used in connection with the installation of piping, shall mean hidden from view behind chases, furred spaces, pipe shafts, or above suspended ceilings.
  6. "Concealed Spaces of Combustible Construction shall be as defined in NFPA#13, Section 8.15.1.
  7. "Contractor" shall mean the Fire Protection contractor and his vendors, fabricators or subcontractors.
  8. "Design Drawings" shall mean documents, including drawings and written specifications, prepared by the Architects and Engineers, to obtain building permits and competitive bid proposals from contractors, for construction of the specified fire protection systems.
  9. "Working Plans" shall mean documents, including calculations, drawings and material specifications prepared by the fire protection contractor, according to NFPA#13, for obtaining approval from the authority having jurisdiction, Owner's insurance underwriter, Architect/Engineer and the State Fire Marshal.
  10. "NPS" shall mean nominal pipe size, in inches.
  11. "CPVC" shall mean Chlorinated polyvinyl chloride plastic.
  12. "Owner" shall mean Brandywine School District.
  13. "Architect" shall mean the Architect of Record as denoted in this package.
  14. "Engineer" shall mean the Engineer of Record as denoted in this package.
  15. "UL" means Underwriter's Laboratories
  16. "FM" means Factory Mutual.

17. "Sprinkler System" shall mean piping and sprinklers under the individual control of a supervised control valve, with provisions for alarm annunciation, alarm testing and system drainage.
  18. "Standpipe" shall mean piping, valves, hose connections, and allied equipment with the hose connections located such that water can be discharged through attached hose and nozzles, for the purpose of extinguishing a fire, thereby protecting a building, structure, its contents, and the occupants.
  19. Reference applicable NFPA Standards for additional definitions that shall apply to work under this Section.
- B. The use of the Design Drawings and Specifications by the contractor, for Bid Proposal and Working Drawing preparation, shall include the following understandings:
1. The information included in the drawings and specifications is given as a guide only, to indicate general design feasibility and to show an acceptable arrangement of system zones, system types, sprinkler positions, main piping location and equipment layout.
  2. The design drawings utilize symbols and diagrams to indicate required work, representing only the sequence of items to be installed, which have no dimensional significance and do not indicate every required item to be provided. The work shall be installed in accordance with the diagrammatic intent expressed on the drawings, in conformity with the dimensions indicated on the final architectural and structural working drawings, and final equipment shop drawings. Information regarding general construction shall be derived only from the Architectural and Structural Design Drawings and Specifications.
  3. The drawings and specifications are complementary and are to be utilized together for a complete interpretation of the work intended. The higher capacity or standard shall be provided, where conflicts between the drawings and specifications, or conflicts within themselves, occur.
  4. The limitations of the language used on the drawings and specifications shall not be interpreted as meaning that accessories and appurtenances, required for completion of work, are to be excluded. The description of any item, on the drawings or in the specifications or both, requires the installation of all its necessary components for approved, satisfactory operation. These drawings do not indicate sprinkler head locations. The Contractor shall reference the architectural reflected ceiling plans. The intent is to establish an architecturally acceptable arrangement of sprinklers with other ceiling elements including lights, diffusers, speakers etc., to be repeated in similar areas. Provide sprinklers according to the NFPA#13 occupancy hazard classification and spacing rules, for unfinished ceiling area.
  5. Submission of a bid proposal requires the contractor to review all project documents and visit the construction site, to be thoroughly familiar with all requirements for the project, and identify in his bid, conditions that may affect the efficient and satisfactory performance of the work. Claims for additional compensation shall be denied if the above procedures are not followed and the disputed conditions may have been identified by the completion of these required tasks.
  6. The information shown on the design drawings and written in the specifications shall not be interpreted as to instruct the contractor to not follow the applicable codes or local amendments. Where the information provided is believed not to be in conformance with the code requirements, the contractor shall notify the Architect and Engineer for clarification prior to the submission of his bid proposal.
  7. References to providing sprinklers per the NFPA#13 Standard mandates that all building areas shall be provided with complete, full sprinkler protection, unless specific notation is made to the contrary on the drawings or in the specification.

8. References in this Specification to NFPA Standards as design and installation guidance of fire protection systems, invoke all of the Sections, Subsections, Exceptions and Advisory Provisions of the Standard that are applicable to the Project's requirements; they are hereby included in this Specification as if repeated in their entirety, and are referenced to convey the minimum acceptable performance and installation requirements acceptable.

#### 1.4 SPRINKLER SYSTEM PERFORMANCE REQUIREMENTS

- A. Design sprinkler system piping according to the following requirements and obtain approval from authorities having jurisdiction, Owner's insurance underwriter, Architect, Engineer and Fire Marshal. Refer to Section 1.7 QUALITY ASSURANCE, paragraph I, Working Plans and Hydraulic Calculations, and Section 3.1 PREPARATION WORKING OF PLANS, for additional system performance related design requirements.
- B. Design sprinkler system piping according to the following:
  1. Include 10 psi cushion pressure as a margin of safety in available water flow and pressure calculations.
  2. Include losses from point of connection to city water main, through water-service entrance, backflow preventer, sprinkler system piping, including all valves, fittings and devices.
  3. Maximum piping velocity shall be limited to 20 fps.
  4. Sprinkler Occupancy Hazard Classifications shall be as follows:
    - a. Classrooms, Art Rooms, Music Rooms, Multi-Purpose Room: Light Hazard
    - b. Offices, Corridors, Toilet rooms, Locker rooms, Public Areas, Cafeteria Seating Areas: Light Hazard
    - c. Building Service Areas, Kitchen, Janitor's Closets, Electrical and Telephone Equipment Rooms and Closets, Mechanical Equipment Rooms: Ordinary Hazard, Gp. 1.
    - d. General Storage Areas, Stage Loading Docks: Ordinary Hazard, Gp. 1.
    - e. Combustible construction and Combustible concealed spaces: Light Hazard.
    - f. All other occupancies and hazards not noted, shall be in accordance with NFPA.
  5. Minimum Density for Automatic-Sprinkler Piping Design shall be as follows:
    - a. Light Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area unless otherwise indicated on drawing data schedule.
    - b. Ordinary Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area unless otherwise indicated on drawing data schedule.
    - c. Ordinary Hazard, Group 2 Occupancy: 0.20 over 1,500 sq. ft. area unless otherwise indicated on drawing data schedule.
    - d. Combustible construction and Combustible concealed spaces: 0.10 gpm over 1500-sq. ft. area unless otherwise indicated on drawing data schedule.
    - e. Special Occupancy Hazard: As determined by authorities having jurisdiction.
    - f. For light and ordinary hazard occupancies, where the requirements of NFPA 13 are met, design are reduction for quick response sprinklers may be used.
- C. Components and Installation shall be capable of producing piping systems with 175-psig minimum working-pressure rating, unless otherwise indicated.

#### 1.5 SUBMITTALS

- A. The contractor shall provide Submittals according to Section 220010, with all required drawings, calculations and product data for complete review of the proposed system installation submitted

at the same time. Incomplete submittals shall be returned unreviewed. When resubmittals are required, all changes from the original submittal shall be clearly identified with revision triangles and clouds.

- B. Product Data shall be provided for the following:
1. Pipe and fitting materials and methods of joining for sprinkler piping.
  2. Pipe hangers and supports.
  3. Valves, including specialty valves, accessories, and devices.
  4. Alarm devices. Include electrical data.
  5. Air compressors. Include electrical data.
  6. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
  7. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
  8. Fire stopping product materials and U.L. listed installation details for penetrations of fire-rated walls and floors.
  9. Fire hose station equipment including hose valves, hose adapters and hose cabinets.
- C. Sprinkler Drawings: Working plans and hydraulic calculations, shall be prepared according to NFPA #13, and submitted to the authorities having jurisdiction, Owner's insurance agent, Architect, Engineer, and State Fire Marshal for approval.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA #13, including the "Contractor's Material and Test Certificate for Aboveground Piping" for each system.
- E. Maintenance Data: shall be submitted for each type of sprinkler component and specialty, and included in the maintenance manuals, specified in Division 1.
- F. Record Drawings: Refer to Division 1 for requirements. An up to date set of working drawings shall be kept at the site to record minor change in the intended system installation, as as-built conditions. Provide the required copies of final working drawings, corrected to show all as-built conditions, to the Owner, and the Owner's insurance agent upon completion of the project.
- G. System Diagram and Operating Instructions: Provide at the completion of work, a color coded, neatly drawn small scale plan, mounted in a substantial glass enclosed frame, showing the locations of all sprinkler system control valves, auxiliary low point drains and inspector's test connections. Provide a minimum of two (2) copies of the current edition of NFPA#25, "Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems".
- H. Guarantee: The contractor shall submit a written guarantee of all materials and workmanship for a period of one (1) year, beginning at the date of final acceptance or beneficial use to the Owner, which includes emergency repair service for sprinkler systems, within four (4) hours, on a twenty-four (24) hour, seven (7) day a week basis, upon request for repair service by the Owner.
- 1.6 QUALITY ASSURANCE
- A. All materials, specialty products, equipment, methods of installation, and the application of materials and products in specific situations, shall be in strict accordance with the applicable requirements of NFPA #13, and have the prior approval of the authority having jurisdiction. All materials and equipment shall be U.L. labeled and/or F.M. approved, and installed in accordance with their listings.

- B. Installer Qualifications: An experienced installer who has designed and installed fire-suppression systems similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
- C. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's and/or Fire Marshal's "Fire Protection Equipment Directory" and that comply with other requirements indicated.
- D. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
- E. Working Plans and Hydraulic Calculations
  - 1. Design the specified sprinkler systems utilizing hydraulic calculations and indicate the intended installation of systems accurately on minimum 1/8" scale plans, with 1/4" scale details which include the following:
    - a. Building section/elevation details, with all necessary elevation data shown.
    - b. Riser diagram of system water supply and backflow prevention.
    - c. All pipe lengths, diameters, fittings, hangers locations and details, earthquake bracing and restraints, valves and devices with piping details.
    - d. A site plan indicating project location, site elevations, north arrow, street intersections, Fire Department access lane(s), location of Fire Department connection(s), and size, material and location of public, and private fire water service mains and their appurtenances. The site plan shall be scaled or indicate dimensions and distances (of mains) and show location of water flow test(s).
    - e. Hydraulically most remote design area(s) with hydraulic nodes on plans corresponding to hydraulic calculations.
  - 2. Provide hydraulic calculations utilizing Hazen-Williams formula for determining piping friction losses, to prove the intended design, according to the requirements NFPA#13, using "C" values therein, which include the following:
    - a. Each type of pipe and joining method to be used, including weight, schedule, wall thickness, exact internal diameters, wall thicknesses and corrosion resistance ratio (CRR), for pipes other than Sch. 40.
    - b. The K-factor, orifice diameter, and minimum operating pressure required, for each flowing sprinkler in the hydraulically most remote area(s), according to the worst-case requirements of either NFPA#13, the local Fire Dept., or the appropriate approval/U.L. listing pressure required, to deliver the required minimum water distribution. Flows shall be calculated to the nearest 1/10 gallon.
    - c. Piping friction losses calculated to the nearest foot for all pipe lengths over (1) foot; all vertical lengths shall be included to show loss or gain of elevation pressures. Pressures shall be calculated to the nearest 1/100 psi.
    - d. Pressure losses for dry valves, deluge valves, backflow preventers etc., shall be clearly indicated as a device, and expressed as additional feet of pipe.
    - e. Velocity in all piping to be 20 feet per second or less. Velocity pressure may be ignored in hydraulic calculations.
    - f. Provide hydraulic calculations in an "easily reviewable" format, similar to the traditional NFPA#13 presentation, including the name of the hydraulic calculation program used, if applicable. The order of entry shall follow the flow of water from the most remote design sprinkler back to the riser, with flows added and subtracted at the cross main; order entry based upon only a sequential ordering of the node numbers, which could result in jumps

from one pipe segment to a disjunct segment, is not "easily reviewable", and therefore is not an acceptable submittal format.

- g. All notes in the hydraulic calculations corresponding to the calculated results shall be clearly identified on the plans, including the site plan.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounting steel cabinet and hinged cover, with space spare sprinklers plus sprinkler wrench. Include the minimum number of each type of sprinkler in the project, as required by NFPA #13.

#### 1.8 LEAK DAMAGE

- A. The fire protection contractor shall be responsible during the installation and testing of the sprinkler system(s), for damage to building, it's contents, the work of other trades etc., caused by leaks or overflow from equipment, defective valves, disconnected or unplugged pipes, fittings etc., and shall pay for the repair or replacement of work or facilities damaged by such leaks.

### **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. Specialty Valves and Devices:
    - Vicatulic Company
    - Tyco Fire Suppression & Building Products
    - Reliable Automatic Sprinkler Co., Inc.
    - Viking Corp.
  - 2. Fire Hose Valves, Hose, Nozzles, and Cabinets:
    - Elkhart Brass Mfg. Co., Inc.
    - Fire-End and Croker Corp.
    - Potter-Roemer
  - 3. Sprinklers:
    - Tyco Fire Suppression & Building Products
    - Reliable Automatic Sprinkler Co., Inc.
    - Viking Corp.
    - Victaulic Company
  - 4. Fire-Protection-Service Valves:
    - Tyco Fire Suppression & Building Products
    - Central Sprinkler Corp.
    - Nibco, Inc.
    - Stockham Valves & Fittings, Inc.

Victaulic Company

5. Keyed Couplings for Steel Piping: (Grooved Fittings)

Tyco Fire Suppression & Building Products

Victaulic Company

Viking Corp.

Anvil International Grulok

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials in specific fire protection services. All piping shall be permanently marked continuously along its length by the manufacturer, properly identifying the type of pipe. All fittings shall be stamped or embossed by the manufacturer, indicating the size, pressure rating, and U.L. listing or F.M. approval.

2.3 PIPES AND TUBES

- A. Standard-Weight Steel Pipe: ANSI/ASTM A 53, ASTM A 135, or ASTM A 795; Schedule 40 in NPS 6" and smaller, and Schedule 30 in NPS 8" and larger, may be joined with threads or cut-groove couplings and fittings, for pressures up to 300 psi.
- B. Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30, or ASTM A 795 and ASME B36, 10M, Schedule 30 wrought-steel pipe, may be joined by welding or roll-groove couplings and fittings, for pressures up to 300 psi.
- C. Schedule 10 Steel Pipe: ASTM A 135 Schedule 10 in **NPS 5"** and smaller and NFPA #13 specified wall thickness in **NPS 6" to NPS 10"**, may be joined by welding or roll-groove couplings and fittings, for pressures up to 300 psi. (DESIGNER NOTE: FURLOW ASSOCIATES, INC. STANDARD IS NOT TO PERMIT "THINWALL/SCHEDULE 10 UNLESS CLIENT REQUESTS, CLIENT STANDARD, ETC.)
- D. "THINWALL/SCHEDULE 10," "XL" AND CPVC piping shall not be permitted on this project.

2.4 PIPE AND TUBE FITTINGS

- A. Cast-Iron Threaded Flanges: ASME B16.1.
- B. Cast-Iron Threaded Fittings: ASME B16.4.
- C. Malleable-Iron Threaded Fittings: ASME B16.3.
- D. Steel, Threaded Couplings: ASTM A 865.
- E. Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.
- F. Steel, Grooved-End Fittings: UL-listed and approved, **ASTM A 47**, malleable iron or ASTM A 536, ductile iron; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

2.5 JOINING MATERIALS

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for pipe-flange gasket materials and welding filler metals.
- B. Steel, Keyed Couplings: UL 213 and AWWA C606, for steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gaskets, and steel bolts and nuts. Include listing for dry-pipe service for couplings for dry piping.

## 2.6 FIRE-PROTECTION-SERVICE VALVES

- A. General: UL listed and approved, with minimum 175-psig nonshock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.
- B. Gate Valves, NPS 6" and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and rising stem.
- C. Indicating Valves, NPS 3" and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device.  
Indicator: Visual.  
Indicator: Electrical 115-V ac, prewired, two-circuit, supervisory switch.
- D. (Optional Section) Gate Valves, NPS 4" and Larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
- E. Swing Check Valves, NPS 2" and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
- F. Swing Check Valves, NPS 2-1/2" and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
- G. Split-Clapper Check Valves, NPS 4" and Larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.

## 2.7 SPRINKLERS

- A. Utilize quick-response sprinklers throughout Light and Ordinary Hazard occupancies
- B. Automatic Sprinklers: shall have heat-responsive element complying with the following:  
UL 199, for applications except residential.  
UL 1767, for early suppression, fast-response applications.
- C. Sprinkler Types and Categories: Nominal 1/2-inch standard orifice, unless otherwise indicated or required by application.
- D. Sprinkler types, features, and options include the following:  
Dry upright sprinklers  
Dry pendent sprinklers  
Horizontal Dry/Sidewall sprinklers  
Pendent sprinklers (Flush, recessed and/or concealed)  
Quick-response sprinklers  
Sidewall sprinklers  
Upright sprinklers
- E. Sprinkler Finishes: Upright bronze, and "white" painted pendants and sidewalls.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.  
Ceiling Mounting: White-plated steel, two piece, flat.  
Ceiling Mounting: Metal, white finish, two piece, flat.  
Sidewall Mounting: White-plated steel, two piece, flat.  
Sidewall Mounting: Metal, white finish, two piece, flat.

- G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.
- H. Sprinkler Water Shields: Shield for protecting sprinkler, heat-sensing operating element from other sprinkler water discharge (pendent and/or upright sprinkler water shield).

## 2.8 SPECIALTY SPRINKLER FITTINGS

- A. Specialty Fittings: UL listed and approved; made of steel, ductile iron, or other materials compatible with piping.
- B. Locking-Lug Fittings: UL 213, ductile-iron body with locking-lug ends.
- C. Mechanical-T Fittings: UL 213, ductile-iron housing with pressure-responsive gasket, bolts, and threaded or locking-lug outlet.
- D. Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gaskets, bolts, and threaded or locking-lug outlets.
- E. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.
- F. Sprinkler, Drain and Alarm Test Fittings: UL-listed, cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.
- G. Sprinkler, Branch-Line Test Fittings: UL-listed, brass body; with threaded inlet and capped drain outlet and threaded outlet for sprinkler.
- H. Sprinkler, Inspector's Test Fittings: UL-listed, cast- or ductile-iron housing; with threaded inlet and drain outlet and sight glass.

## PART 3 – EXECUTION

### 3.1 PREPARATION OF WORKING PLANS

- A. The contractor shall be responsible for reviewing the Architectural and Structural Design Drawings and verifying with the General Contractor, that substitutions of noncombustible building materials with combustible building materials have not been made that alter the requirements of the sprinkler system shown on the Fire Protection Design Drawings. Report such substitutions to the Architect and Engineer for review, prior to the design of sprinkler systems. Combustible framing or construction is not allowed above ceilings, below floors or in concealed spaces, unless specifically protected by sprinklers.
- B. The final arrangement, positions and connections of pipes, drains, valves, sprinklers etc., shall be established by the fire protection contractor's design, and shall be configured to drain fully, avoiding trapped piping sections and excessive auxiliary drains. Sprinkler systems shall be installed concealed above architectural suspended ceilings where ceilings are provided, unless indicated otherwise.
- C. Design the specified fire protection systems from the fire service entry riser, in accordance with the mandatory requirements and all advisory provisions of NFPA#13, the requirements of the authority having jurisdiction and the Owner's insurance agent, utilizing hydraulic calculations, with uniform water distribution over each most remote design area and/or specified demand.
- D. Establish each sprinkler position, giving full consideration to the vertical and horizontal obstructions to sprinkler spray pattern development that may be presented by building construction, ductwork, mechanical and electrical equipment, piping, soffits and ceilings constructed with different adjacent elevations, suspended and surface mounted lighting fixtures etc.; coordinate the position and location of sprinklers, piping and system components, referencing the detailed working drawings of all other trades, to avoid installation conflicts.
- E. Contractor shall be responsible for planning and providing the required penetrations of fire rated walls, floors and smoke partitions, in such a manner that U.L. listed details that restore their fire

rating integrity and that have prior approval of the Delaware State Fire Marshal's Office where they are utilized.

- F. Where practical, uniformly space sprinklers on branchlines; sprinklers shall be spaced in architectural patterns consistent with symmetrical positions of lights, air diffusers, speakers, and other ceiling elements, where sprinklers are shown on architectural reflected ceiling grid plans.
  - 1. Pendent sprinklers in architectural ceilings shall be centered in square ceiling tiles in both directions, and centered in the short dimension of rectangular tiles, with sprinkler positions acceptable at quarter points of the long dimension, +/- 12".
  - 2. Provide sprinkler spacing and locations per NFPA#13 requirements, in areas without suspended ceilings.
- G. Wet sprinkler systems may be "tree", "loop" or "grid" type systems, as may be hydraulically advantageous, unless a specific piping arrangement is indicated on the design drawings. System piping arrangement shall be configured above the top of recessed lighting fixtures, within suspended ceilings.
- H. Where sprinkler piping within concealed spaces provides protection for occupancies below, sprinklers for protection of concealed spaces may be attached to the same piping system. Hydraulically calculate each set of sprinklers separately and provide pipe sizes for the hydraulically more demanding group.
- I. Sprinklers for the protection of attic spaces may be conventional upright or pendent types, or a combination of these types of sprinklers. The position of sprinklers in attics framed of combustible construction, shall establish sprinkler protection into the eaves overhanging the outside of the building.
- J. Provide sprinkler protection in combustible framed, horizontal and vertical soffits and wall cavities, with outside finished dimensions greater than 14." Where combustible concealed construction and spaces are permitted to be unsprinklered, meeting one or more of the exceptions of NFPA#13, Section 8.15.1.1, the design area of application shall be increased to a minimum of 3,000 sq.ft., without revising the hydraulic density, per NFPA#13, Section 11.2.3.1.5 and 11.2.3.2.
- K. Where used, antifreeze systems shall use pharmaceutically pure glycerin or propylene glycol only and shall be premixed in accordance with NFPA 13. Provide a reduced pressure zone backflow preventer assembly and an expansion chamber where noted on the drawings, at the point of connection to the wet sprinkler system supply. Pipe discharge port of backflow preventer to a drain point capable of accepting full flow discharge. Antifreeze systems over 40 gallons total capacity shall be hydraulically calculated using the Darcy-Weisback equation, Moody Diagram, E-factors for age of pipe, and adjusted K-factors for fluid properties.

### 3.2 PIPING APPLICATIONS

- A. Flanges, unions, transitions and special fittings shall have pressure ratings the same as or higher than system's static pressure rating for use in aboveground applications, unless otherwise indicated.
- B. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
- C. Underground Service-Entrance Piping: Use ductile-iron, push-on-joint pipe and fittings and restrained joints.  
Fire Suppression Bulk Mains and Risers: See Fire Protection Drawing.
- D. Wet-Pipe Sprinkler Branch Piping: See Fire Protection Drawing.

1. NPS 2-1/2" and Larger: Standard weight (Schedule 10) steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved couplings.
  2. NPS 2" and Smaller: Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
- E. Drypipe Sprinkler Branch Piping: See Fire Protection Drawing.
1. NPS 2-1/2" and larger: Standard weight, hot dipped galvanized steel pipe with grooved ends, steel grooved-end fittings and grooved couplings.
  2. NPS 2" and smaller: Standard weight, hot dipped galvanized, steel pipe with threaded ends, cast or malleable iron, threaded fittings and threaded joints.
- ### 3.3 VALVE APPLICATIONS
- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Fire-Protection-Service Valves: UL listed and approved for applications where required by NFPA#13.  
Shutoff Duty: Use gate and/or butterfly valves.
  2. General-Duty Valves: For applications where UL-listed and approved valves are not required by NFPA #13.  
Shutoff Duty: Use gate, ball, or butterfly valves.
- ### 3.4 JOINT CONSTRUCTION
- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction. Apply joint compound or tape to male threads only.
- B. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with only roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.
- C. Locking-Lug-Fitting, Twist-Locked Joints: Follow fitting manufacturer's written instructions.
- D. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for dielectric fittings.
- ### 3.5 PIPING INSTALLATION
- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
1. Deviations from approved working plans for piping installation require written approval from authorities having jurisdiction. File copy of written approval with Architect before deviating from approved working plans.
- C. Use only approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes. Bushings shall not be used.
- D. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections. Not required on grooved connections.
- E. Install "Inspector's Test Connections" for each sprinkler system, sized and located according to NFPA #13 requirements. Install main drain test connection at location that will permit full flow

discharge for a time sufficient to allow for proper testing of water supplies, without flooding or water damage.

- F. Install sprinkler piping to avoid excessive auxiliary drains. Provide auxiliary drains as required for complete drainage of trapped piping sections.
- G. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.
- H. Install ball drip valves to drain piping between fire department connections and check valves. Drain ball drips to floor drain or outside building.
- I. Install alarm devices in piping systems.
- J. Hangers and Supports: Comply with NFPA #13 for hanger materials and installation. Hangers, hanger rods and attachments must be capable of supporting five (5) times the weight of the water-filled pipe, plus 250 pounds minimum, at each point of hanging. Piping shall be supported from building structure only, and shall not be hung from ductwork, conduit runs or other piping. Install piping straight and true, parallel with building walls, without dips or sags. Piping shall bear evenly on all pipe hangers. Provide complete details of earthquake bracing and flexible couplings consistent with the requirements of the seismic zone of the project location.
- K. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
- L. Install pressure gages on system risers and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

### 3.6 SPECIALTY SPRINKLER FITTING INSTALLATION

- A. Install specialty sprinkler fittings according to manufacturer's written instructions.

### 3.7 VALVE INSTALLATION

- A. Refer to Division 22 Section "Valves" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA #13, manufacturer's written instructions, and authorities having jurisdiction.
- B. Gate/Butterfly/Valves: Install fire-protection-service valves supervised-open, unless noted otherwise, located to sectionalize system and control sources of water supply, except from fire department connections. All sectional control valves shall be installed in accessible locations.
  - 1. Provide drains at all sectional control valves. Pipe drains to an acceptable location, capable of accepting full flow discharge without flooding or damage. Provide permanent identification signs indicating portion of system controlled by each valve, according to NFPA#13 requirements.

- C. Install check valve in each water-supply connection. Install UL listed fire protection backflow preventers instead of check valves in potable-water supply sources.
- D. Riser Check Valves: Install valves in vertical position unless noted otherwise, for proper direction of flow.

### 3.8 SPRINKLER APPLICATIONS

- A. General: Only new sprinklers shall be installed, according to their listing requirements. Ornamental finishes shall be factory applied only. Position sprinkler deflectors at the same elevation, parallel with ceiling plane.
- B. Use sprinklers according to the following applications:
  - 1. Rooms without Ceilings: Upright sprinklers.

2. Rooms with Suspended Ceilings: Pendent, sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
5. Special Applications: Use quick-response sprinklers where indicated.
6. Sprinkler Finishes: Use sprinklers with the following finishes:
  - a. Upright, Pendent, and Sidewall Sprinklers: White-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

### 3.9 SPRINKLER INSTALLATION

- A. Install sprinklers in patterns indicated. Install sprinklers in suspended ceilings in center of acoustical panels and tiles.
  1. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical panels, and quarter points of the long dimension.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space,
- C. Install approved sprinkler guards at all sprinklers installed below 7'-6", or where mechanical damage is possible.
- D. Install sprinklers in accordance with manufacturer's requirements.

### 3.10 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA #13, Division 22 Section "Basic Mechanical Materials and Methods", and the Delaware State Fire Prevention Regulations.

### 3.11 FIELD QUALITY CONTROL

- A. Provide a flanged spool section of pipe and a temporary conical type strainer on the incoming fire protection water service, before the building fire protection and sprinkler system equipment (backflow preventer, fire pump, etc.), for the fire protection system during installation. Prior to the final commissioning, remove the strainer and reinstall flanged spool section.
- B. Flush, test, and inspect sprinkler piping according to NFPA #13, "System Acceptance" Chapter.
- C. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- D. Report test results promptly and in writing to Architect and authorities having jurisdiction.

### 3.12 CLEANING

- A. Clean dirt and debris from sprinklers, remove protective covers used during painting.
- B. Remove and replace sprinklers having paint other than factory finish.

### 3.13 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion.

### 3.14 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that specified tests of piping are complete.
- C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.

- D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- E. Fill wet-pipe sprinkler piping with water.
- F. Adjust operating controls and pressure settings.
- G. Coordinate with fire alarm tests. Operate alarm devices with water, as required to demonstrate proper function.
- H. Provide a flow test for record on the site fire hydrants nearest the building regardless of the previous date. Data to be included below.
- I. Provide an 8-1/2" x 11" drawing in "pdf" format for the Owner, Local Fire Department and the Fire Marshal's Office. Data required on drawing shall indicate the following:
  - 1. Name, address and location of the building.
  - 2. The location of all fire suppression system control valves.
  - 3. Main entrance and exits.
  - 4. Name, and telephone numbers of responsible personnel for responding during emergencies.

### 3.15 SYSTEMS ACCEPTANCE AND TESTING

- A. Notify the Authority Having Jurisdiction, the Owner's representative, and Architect and Engineer of time and date of scheduled testing. Provide minimum of 5 day prior notice of testing to allow for witnessing.
- B. Perform all required system testing and acceptance requirements on the new (and modified) system installations in accordance with NFPA 13 & 25, the Delaware State Fire Prevention Regulations, the Authorities Having Jurisdiction (AHJ) requirements and all other local codes and ordinances. At a minimum provide the following:
  - 1. Perform all acceptance requirements per the codes; pipe flushing, inspections, etc.
  - 2. Perform all operational and functional tests of systems and equipment required by the codes and equipment manufacturers.
  - 3. Perform hydronstatic pressure test on new (and modified) above ground systems piping in accordance with NFPA 13. New system shall be tested to 50 psi over normal system working pressure (minimum 200 psi) for 2 hours without leaks.
- C. Provide all required reports, records and documentation, to the owner, engineer and authority having jurisdiction prior to or at the completion of the project. At a minimum provide the following:
  - 1. Completed and signed "Contractor's Material and Test Certificate for Aboveground Piping' for each system.
- D. Prior to placing systems in final service, provide a final inspection of new and/or modified systems to ensure item such as protective caps & straps have been removed or put in place, escutcheons have been install, penetrations seals have been provided, ceiling tiles have been replaced, etc.

### 3.16 DEMONSTRATION

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. Schedule demonstration with Owner with at least seven days' advance notice.

END OF SECTION 21 0170



## SECTION 22 0000

### GENERAL PROVISIONS - PLUMBING/FIRE PROTECTION

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and all other applicable Divisions, apply to work of this Section.
- B. This specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.
- C. All fire protection suppression systems shall be part of and included in all of the following 220000 thru 220191 Sections.

##### 1.2 WORK INCLUDED

- A. Provide labor, materials, equipment and supervision necessary to install complete operating Plumbing and Fire Protection Systems as indicated the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.

##### 1.3 REGULATIONS, CODES AND STANDARDS

- A. Work shall be performed in accordance with latest adopted codes, regulations and ordinances by authorities having jurisdiction. Observe all safety regulations.
- B. Latest editions of any referenced standards shall govern.
- C. Obtain all municipal and/or the Authorities Having Jurisdiction permits and inspection certificates and pay all charges.
- D. Make or arrange for any/or all inspection agency reviews or visits and pay all charges. This includes communication with each respective agency and/or utility to verify the project system work, coordination responsibilities, fees, back charges, etc., required.
- E. All fees and back charges shall be verified during the bidding phase of the work. Any discrepancy of this item between any utility, inspection agency and the Contractor shall be brought to the attention of the A/E prior to bid opening.
- F. Submission of a bid will be deemed evidence of having complied with these requirements.

##### 1.4 RELATED WORK

- A. Refer to equipment shown or specified in all other applicable Divisions that require Plumbing and Fire Protection services.
- B. Refer to work related to Plumbing and Fire Protection as shown on the following contract drawings:
  - Architectural & Structural
  - HVAC
  - Electrical

##### 1.5 COORDINATION

- A. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed. Any necessary changes required will be included as part of this contract.

- B. Plumbing and Sprinkler Contractors shall coordinate scheduling, submittals and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of independent work elements, with provisions to accommodate items that may be installed at a later time.
- C. Plumbing and Sprinkler Contractors shall verify utility requirements and all characteristics of operating equipment are compatible with the building utilities. Coordinate the work of all sections related and required for installing, connection and placing in service of all equipment.
- D. Plumbing and Sprinkler Contractors shall coordinate all space requirements, supports and installation of all mechanical, electrical, plumbing and fire protection work, which are indicated diagrammatically on the Drawings. Verify routing of all pipes, ducts, conduits and equipment connections. Maximize accessibility for other work, and service requirements for maintenance and repairs.
- E. Obtain written confirmation from all related trade Contractors and the Owner or his representative that requirements, conflicts and coordination issues have been discussed and resolved.

#### 1.6 SUBMITTALS

##### A. Shop Drawings & Product Data:

1. Shop drawings and product data shall be submitted in accordance with Division 22 specifications except where herein modified.

**NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.**

2. Listed are the required shop drawings and reports required for this project. The Engineer/Owner shall reserve the right to require additional submissions not listed below:
  - All fixtures, equipment and associated devices so listed on the Fixture Schedule on Drawing.
  - Insulation
  - All specified piping systems.
  - All specified valves.
  - Gauges and thermometers
  - Hanger and supports including Sumner system.
  - Piping labels and identification.
  - Sprinkler System and all related data, devices, switches and trimmings.
  - Testing reports.
  - Sterilization report.
  - Operating/Maintenance manuals.
  - As-Built Drawings.
3. Submittals comprising complete catalog cuts, shop drawings and performance test data for Plumbing materials and equipment as required by other sections of Division 22, shall be submitted for review checking. The Contractor shall review these for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, samples and similar materials, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the requirements contained in the contract documents for the work of all trades.
4. All submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto.

- a. Project name.
  - b. Project number.
  - c. Sub-contractor's, vendor's and/or manufacturer's name and address.
  - d. Product identification.
  - e. Identification of deviation from contract documents.
  - f. Applicable contract drawings and specification section number.
  - g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
  - h. Resubmit revised or additional submittals as requested.
  - i. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the contractor making the submission to identify by name, the contractor who is to do this work. If the contractor named is other than the contractor making the submission, the shop drawing submission must be reviewed by the named contractor and bear his mark of approval, prior to submission to the Architect/Engineer.
  - j. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.
  - k. The Contractor shall keep one copy of approved shop drawings at the job site,, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.
  - l. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.
- B. Contractor is responsible for the shop drawing coordination and interface with the work of other contracts and adjacent work. The relationship of Contractor's work shall be verified as it relates to adjacent and critical features of the work of this and all contracts and materials.
- 1.7 WARRANTY/GUARANTEE
- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in all other applicable Divisions. In addition, refer to specifications for special guarantees.
  - B. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the contract documents.
- 1.8 SITE INSPECTION
- A. The Contractor shall visit the site, inspect, and become aware of all conditions which may affect the work during the estimation phase of his work and prior to bid openings. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
  - B. Submission of a bid will be deemed evidence of having complied with this requirement.
- 1.9 SUBSTITUTIONS
- A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.
  - B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the Contractor or an equipment vender to deviate from the written portion of the specifications unless so stated in the

addendum.

- C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.
- D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements as indicated on all contract documents and as described within the specifications. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, then they shall be responsible for any and all additional costs associated with the changes required by other trades.

#### 1.10 LUBRICATION

- A. Furnish, install and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.
- B. Provide one year's supply of lubricants to Owner at date of acceptance.
- C. Verify that required lubrication has taken place prior to any equipment start-up.

#### 1.11 EQUIPMENT START-UP

- A. Verify proper installation by manufacturer or his representative.
- B. Advise General Contractor 2 days prior to actual start-up.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.

#### 1.12 OPERATION & MAINTENANCE INSTRUCTIONS

- A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.
- B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each system as a whole.
- D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.
- E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
- F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.
- G. Provide to the Owner any special tools necessary for operation and routine maintenance of any of the equipment.

#### 1.13 TOOLS

- A. All equipment furnished by the Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

#### 1.14 CLEANING AND FINISHING

- A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.
- B. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.
- C. All NEW fixtures, piping, finished surfaces and equipment installed shall have all grease, adhesive labels and foreign materials removed.
- D. All new piping installed shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, flush valves and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation ten (10) days.
- E. Gas piping shall be blown out with clean compressed air or inert gas.
- F. When connections are made to existing systems, the Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.
- G. Clean-up: Remove from the premises, all unused material and debris resulting from the performance of work under this section.

### **PART 2 – PRODUCTS**

#### 2.1 GENERAL

- A. All material and equipment shall be new and of present day manufacture, and shall conform to accepted standards of the trade where such a standard has been established for the particular type of equipment or material.
- B. Whenever equipment or material is referred to in the singular, such as "the plumbing fixture", it shall be deemed to apply to as many such items as necessary to complete the work.

#### 2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. During loading, transporting and unloading exercise care to prevent damage to material.
- B. Store all materials in dry enclosures or under protective coverings out of way of work progress.
- C. Material shall not be allowed to be stored directly on ground.
- D. Deliver in manufacturer's original cartons or on skids.
- E. Handle and protect so as to prevent damage to product or any surrounding material.

#### 2.3 CONCRETE

- A. Concrete if used on this project, shall be in accordance with Section 033000.
- B. The 28-day minimum compressive strength shall be 3000 psi.

### **PART 3 – EXECUTION**

#### 3.1 PROTECTION

- A. Plug or cap open ends of piping systems.
- B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.
- C. Protect all installed work until accepted in place by the Owner.

- D. Plates, polished metal escutcheons and other finished devices shall not be installed until masonry, tile, and painting operations are complete unless otherwise protected.
- E. Protect all work from operations which may cause damage such as hauling, welding, soldering, painting, insulating and covering.
- F. Do not remove protective material until equipment is placed in service.

### 3.2 WORKMANSHIP

- A. Install all work neat, trim and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

### 3.3 EXCAVATION

- A. The excavation shall be of the open-trench method and to the depths and widths as may be necessary. The Contractor shall do all excavation required in connection with his work. Bottoms of trenches shall be excavated to a uniform grade. All materials excavated shall be deposited on the side of the trenches and beyond the reach of the slides. Excavated material shall not be piled where it will interfere with traffic. If rock is encountered, it shall be removed by the General Contractor. See provisions in Division 2.
- B. No piping shall be bedded directly on rock. They shall be cushioned by a 6-inch layer of crushed stone or gravel of selected grade, of size to pass through 3/4" mesh sieve. Not less than 30% shall be fine which will pass through a 3/8" mesh sieve.

### 3.4 SHORING AND PUMPING

- A. The Contractor shall provide all shoring, bracing or sheet piling necessary to maintain the banks of his excavation and shall take out same as the work progresses and filling in has been accomplished. Shoring shall be in accordance with OSHA Standards.
- B. The arrangement of shoring must be such as to prevent any movement of the trench banks and consequent strains on the conduits. Shoring shall be provided to prevent damage to work installed by other trades.
- C. The Contractor shall do all pumping required to keep his excavations free of water. The water shall be conveyed in piping or watertight troughs a sufficient distance that it will flow from the site and not affect other work being performed.

### 3.5 BACKFILLING

- A. After work in trenches has been completed, they shall be filled with select fill in 8" layers and shall be pneumatically tamped before the next layer of material has been filled in. The backfill shall be free of excavated rock, cinders, stones, brickbats or other debris.
- B. Wherever rock is removed, the Contractor shall secure and fill select clean earth to a minimum depth of 3'-0" above the top of the pipe. Unless otherwise indicated, no rock shall be deposited in the trench fill. This clean earth fill shall be procured other than from the site unless permission for earth borrow from the site is granted by the Architect. If site borrow is permitted, the topsoil removal, relocation and finished grading will be accomplished as directed by the Architect.
- C. Under no circumstances shall excavated material be left where it will interfere with the Owner's or other Contractor's operations.
- D. All earth and other materials taken from the trenches and not required for backfilling shall be deposited where directed, or removed from the premises as directed by the Architect.
- E. Any rock removed from the excavation shall be removed from the project site by the Contractor.

- F. Trenches which pass under wall footings or within 18" of column footings shall be backfilled with lean concrete. To secure adequate foundation support, the method and depositing of the concrete fill shall be as directed by the Architect. To prevent the concrete from adhering to the pipes, necessary pipe protection shall be applied.

3.6 EQUIPMENT SETTING

- A. Furnish and install as a minimum, a 4 inch concrete pad beneath all floor-mounted equipment. Install anchor bolts in pour.
- B. Furnish and install as a minimum, spring vibration isolation under any equipment 10 HP and over and rubber in shear vibration isolation on any equipment up to 10 HP.
- C. Concrete shall be 3,000 psi, 28 day compressive strength in accordance with ACI-613. Reinforce with No. 4 rod 12" on centers both ways or as otherwise detailed.

3.7 FASTENERS, HANGERS AND SUPPORTS

- A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.
- B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets and anchors necessary to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded more than 1/4 rated capacity or 200 pounds.
- E. Power-driven fasteners shall not be allowed for piping larger than 2 inch, or equipment. When used they shall not be loaded more than 1/8 rated capacity or 200 pounds.
- F. All hangers, miscellaneous steel, braces and supports shall be galvanized, cadmium plated, or primed steel. Copper tubing shall be supported with copper hangers. No direct contact of dissimilar metals between the piping system and its hanger support shall be permitted.
- G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles. Where hangers are 18" or longer, provide lateral bracing at every fourth hanger. See IPC Pipe Support Table below:

PIPE SUPPORT SPACING

Material	Horizontal Max. Feet	Vertical Max. Feet
ABS Pipe	4	10
Aluminum	10	15
Brass	10	10
Brass Tube up to 1-1/4"	6	10
Brass Tube over 1-1/2"	10	10
Cast Iron	5	15
Copper up to 1-1/4"	6	10
Copper over 1-1/4"	10	10
CPVC Up to 1"	3	10
CPVC Over 1"	4	10
Lead Pipe	Continuous	4
PB Pipe/Tubing	2.6 ft. (32")	10
PVC Pipe	4	10

Material	Horizontal Max. Feet	Vertical Max. Feet
PEX	2.6 ft. (32")	10
Steel Tubing	8	10
Steel Pipe	12	15

- H. Support vertical piping at floor levels using approved riser clamps. Clamp material shall be compatible with pipe material. Maximum vertical spacing shall be 10'-0".

### 3.8 SLEEVES

- A. Provide each pipe passing through a masonry or concrete wall, floor or partition with a sleeve made from standard weight steel pipe for pipe with smooth edges, securely and neatly cemented in place. Provide each pipe passing through a frame or metal partition with a sleeve made from No. 22 gauge galvanized sheet metal, securely fastened in place.
- B. Pipe passing through foundation wall or under foundation shall be provided with relieving arch or steel pipe per IPC Section 305.5.
- C. Be responsible for the proper location and alignment of all sleeves.
- D. Provide hydrostatic seals for sleeves passing through outside walls, below grade, or through hydrostatically sealed slabs or floors on grade. Provide fire-rated seals for all other sleeves.
- E. Install both piping and sleeve seals so as to maintain integrity of seals with expansion and contraction of piping.
- F. Set floor sleeves flush with floor surface in finished areas, 1" above the finished floor in kitchens, cafeterias, and similar service areas unless such areas are slab-on-grade; 1" above the floor in mechanical rooms, pipe chases, pipe spaces and other unfinished areas, unless otherwise indicated, and flush with the underside of slabs. Extend wall and partition sleeves through and cut flush with each surface unless otherwise indicated or specified.
- G. Select sleeves two pipe sizes larger than any pipe that is to remain uncovered, unless otherwise required by the sealing method specified. Where pipes are to be covered, provide sleeves large enough to allow the covering to pass through the sleeves with sufficient clearance for sealing as specified hereinafter. Size sleeves for branch piping from vertical risers large enough to permit vertical expansion at the riser.
- H. Place sleeves imbedded in concrete floors or walls in the forms before concrete is poured; sleeves shall have integral waterstop flanges, where they are to receive either watertight or hydrostatic seals.
- I. Install sleeves passing through above-grade floors of mechanical rooms, toilet rooms, kitchens or similar service areas where liquid leaks or spillover may occur in a watertight manner. Sleeves shall be such that waterproofing membrane can be flashed around and into the sleeve where necessary.
- J. Seal sleeves for pipes passing through ceiling air plenum walls or the floor above air tight in a manner similar to that specified for fire-rated sleeves.
- K. Hydrostatic Sealing Method: Provide compressible synthetic rubber seals, equivalent to LINK SEAL, manufactured by the Thunderline Corporation, or THRUWALL manufactured by O.Z. Gedney. Install seals in accordance with the manufacturer's recommendations to provide air tightness aboveground and hydrostatic sealing belowgrade. Caulking or other type mastic is not acceptable.
- L. Fire-Rated Sealing Method:
  - 1. Sleeves, openings and sealants shall comply with applicable codes, recommended practices and

standards, and manufacturer's instructions. Fire sealants shall have ability to prevent spread of flame, smoke or water throughout the penetration and shall pass 3 hour test, UL test ASTM E814 and UL 1479.

2. Products: Chase Corporation CTC PR-855, O. Z. Gedney CRS/CAFS, 3M Electro-Products Division Putty 303 or Caulk CP25 penetration sealing kits, General Electric Company sealants type RTV-850, 6428 or 7403, Thunderline Corporation "Link-Seal Pyro-Pak". Installation and type of sealant to be used as recommended by the manufacturer.
3. Expansion collars, fire seal/firestop collars – ASTM E814 (UL1479). Spec Seal Corporation, Inc. (plastic pipe).

### 3.9 PLATES

- A. Furnish and install chrome plated plates wherever piping passes into finished area.
- B. Plates shall be securely fastened to piping or building construction.
- C. Floor plates shall cover 1 inch sleeve extension.

### 3.10 OFFSETS, TRANSITIONS, MODIFICATIONS

- A. Furnish and install all offsets necessary to install the work and to provide clearance for other trades.
- B. Maintain adequate headroom and clearance.
- C. Incidental modifications necessary to the installation of the systems shall be made as necessary and as approved by the Architect.

### 3.11 RECESSES

- A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, and other equipment or devices which are to be recessed in walls.
- B. Make offsets or modifications as required to suit final locations.

### 3.12 LABELING

- A. All Plumbing equipment such as pumps, and devices requiring identification for operating procedures shall be provided with permanent black laminated micarta white core labels with 3/8 inch letters.
- B. This shall also apply to all controllers, remote start/stop pushbuttons and equipment cabinets.

### 3.13 FLASHING AND COUNTERFLASHING

- A. Roof drains, vents, roof curbs, etc., shall have counterflashing fittings. General Contractor shall provide flashing.
- B. Piping and conduit thru the roof shall be flashed by the General Contractor. Furnish and install counterflashing.

### 3.14 ACCESS

- A. Locate all equipment, valves, devices and controllers which may need service in accessible places.
- B. Where access is not available, access panels shall be provided. Furnish access doors to the General Contractor for installation.
- C. Access doors shall be Elmdor, Karp Co., MIFAB or Controlled Air Manufacturing Limited, with 16 gauge frames and 14 gauge steel door, prime painted.
- D. Maintain required access clearances.

### 3.15 WIRING

- A. Packaged plumbing system equipment shall be furnished with disconnect switches, and magnetic starters, factory furnished and wired by the unit manufacturer.
- B. All control wiring shall be furnished and installed under this Division of the work.

- C. All wiring shall be in accordance with the National Electrical Code and as recommended by the equipment manufacturer.

### 3.16 UTILITIES

- A. Do not interrupt any utility or service to the Owner without adequate previous notice and schedule.
- B. Arrange and pay for the relocation, disconnection or removal of, or relocate, disconnect or remove existing utilities and services where such work is shown or where such utilities or services interfere with new construction, whether or not shown. Provide all excavation, backfilling and paving required by such work.
- C. Perform alteration of utilities and services in accordance with the rules, regulations and requirements of the involved utility companies, regulatory agencies having jurisdiction.

### 3.17 CUTTING AND PATCHING EXTERIOR SURFACES

- A. This Contractor shall be responsible for returning disturbed paved and/or grass areas to original condition where excavation for utilities has been required.
- B. Cut and patch paved areas to match original surface.
- C. Properly tamp backfill before finishing or repairing disturbed area surfaces.

### 3.18 OPENINGS - CUTTING, REPAIRING

- A. This contractor shall cooperate with the work to be done under other sections in providing information as to openings required in walls, slabs and footings for all piping and equipment, including sleeves where required.
- B. Any drilling or cutting required for the performance of work under this Section, shall be the responsibility of this Contractor and the cost thereof shall be borne by him.
- C. Holes in Concrete: Sleeves shall be furnished, accurately located and installed in forms before pouring of concrete. This contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drill or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling.
- D. It shall be the responsibility of this Contractor to ascertain that all chases and openings are properly located.

### 3.19 GUARANTEE

- A. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of one year from the date of acceptance of the work by the Owner unless otherwise specified in other applicable Divisions. Should any trouble develop during this period due to defective materials or faulty workmanship, the Contractor shall furnish all necessary labor and materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

In the event of occupancy by the Owner prior to final acceptance of the project, the guarantee date for equipment placed in operation shall be mutually agreed to by the Contractor and the Owner's representative.

### 3.20 DRAWINGS

- A. The Plumbing and Fire Protection Systems are indicated on the Contract Drawings. Certain pertinent information and details required by the Plumbing and Fire Protection Work appear on the Architectural, Structural and Electrical Drawings; become familiar with all Drawings; and incorporate all pertinent requirements.

- B. Drawings are diagrammatic and indicate the general arrangement of systems and requirements of the Work. Do not scale Drawings. Exact locations of fixtures and equipment, not specifically shown shall be obtained before starting work.
- C. When indicated on the drawings, plumbing riser diagrams are completely diagrammatic and indicate the intent of the work for both the Contractor, L&I review agencies and/or Authorities Having Jurisdiction. Where valves, shock absorbers, incidental equipment, devices, etc., including execution notes are indicated on the riser diagrams, they shall be so required and installed as part of the system work.

### 3.21 RECORD DRAWINGS

- A. As-Built record drawings, showing dimensions, locations and depth of all buried and concealed piping, plugged outlets and equipment shall be kept up to date. Master copy shall be kept on the job. No backfilling of trenches shall be permitted until as-built drawings are approved as up-to-date by the Owner/Representative. No plumbing progress payments shall be approved unless as-built drawings are up- to-date. Depth of sewers shall be from a permanent bench mark as shown on the contract drawings. Refer to project record drawings under General Conditions.

END OF SECTION 22 0000



**SECTION 22 0010**

**BASIC MATERIALS AND METHODS – PLUMBING`**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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 REFERENCE

- A. Install all piping, fixtures, equipment, etc., to meet the requirements of the following:

New Castle County Department of License and Inspection

New Castle County Department of Sewers

Delaware State Plumbing Code

International Plumbing Code

State of Delaware Fire Marshal's Office

International Plumbing Code (All applicable sections)

International Mechanical Code (All applicable sections)

Gas Utility Company

Water Company

NFPA

OSHA

All requirements of the above governing agencies shall be in compliance with the latest issues, rules or regulations in effect.

- B. Appliances and materials governed by UL requirements shall meet such requirements and bear the label.

1.3 QUALITY ASSURANCE

- A. Provide adequate supervision of labor force to assure all aspects of specifications are being fulfilled.
- B. Insure that all work and equipment is installed in accordance with manufacturer's warranty requirements.
- C. Replace all pipes and fittings shown to be defective as a result of testing.

1.4 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
  - 1. Manufacturer's Product Data on all pipe and fittings to be used in project.
  - 2. Manufacturer's Product Data on all valves to be used in project.

1.5 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

## **PART 2 – PRODUCTS**

### **2.1 STEEL PIPE & FITTINGS**

- A. Pipe: ASTM A-53, Schedule 40.
- B. Fittings:
  - 1. Cast iron, threaded, 175 psi, ANSI B-16.4.
  - 2. Malleable iron, threaded, ASA B 16.3.
  - 3. Steel, socket weld, ASTM A-53.
  - 4. Wrought iron, socket weld, ASTM A-72.
- C. Thread tape shall be teflon tape, 3 mils minimum thickness. Teflon tape shall not be permitted for use on gas piping systems.
- D. See Section 220130 for Gas Piping Systems.

### **2.2 CAST IRON PIPE AND FITTINGS**

(Note: Any cast iron piping made or marked “CHINA” will NOT be acceptable on this project)

- A. Aboveground:
  - 1. Pipe & Fittings: Hubless cast iron, CISPI 301, ASTM A-74 and ASTM A-888 shall be marked with the collective trademark of the Cast Iron Institute (soil pipe).
  - 2. Joints: Neoprene sleeve and stainless steel shield and clamp assembly, CISPI 310, ASTM-1277.
- B. Below grade and/or slab: (Contractor's Option)
  - 1. Bell and Spigot: Service weight bell and spigot pattern ASTM-74 with compression type neoprene gaskets ASTM C-564.
  - 2. Hubless: Hubless cast iron pipe CISPI 301, with heavy duty 3.04.016 stainless steel bands for below-grade installation. Elastomeric seal component ASTM C-564 and CSA B-602.
  - 3. Hubless Joints: Cast iron CISPI 310 and as TM C-1277.
  - 4. PVC DWV pipe and fittings, Schedule 40, ASTM D-2665, D2949, F891 and CSA B181.2.
  - 5. Corrosion protection shall be in accordance with IPC 305.1. Provide appropriate wrapping or sheathing when pipe is exposed to lime and acid of concrete, cinder or other corrosive materials.
  - 6. Protection of all below-grade storm and sanitary shall be in accordance with IPC Section 305.
  - 7. All Kitchen and Boiler Room below slab piping shall be service weight cast iron only. PVC not allowed.
- C. Corrosion protection shall be in accordance with IPC 305.1. Provide appropriate wrapping or sheathing when piping is exposed to lime and acid of concrete, cinder or other corrosive materials.

### **2.3 COPPER TUBING**

- A. Domestic hot, cold and recirculated water:
  - 1. Aboveground:
    - a. Tubing: Hard-drawn, seamless ASTM B-88, Type "L".
    - b. Fittings: Solder joint wrought copper ANSI B-16.22.
    - c. Joints: Lead-free solder 410°, ASTM B-32 alloy designation “TC”, ASTM B-828.
    - d. Flux: Non-toxic and non-corrosive, ASTM B-813.
  - 2. Underground:
    - a. Tubing: Soft-drawn, seamless ASTM B-88, Type "K".

- b. Fittings: Solder joint wrought copper ANSI B-16.22.
  - c. Joints: Lead-free solder 410°, ASTM B-32, ASTM B-828.
  - d. Flux: Non-toxic and non-corrosive, ASTM B-813.
- B. Drainage and vent piping:
- 1. Aboveground:
    - a. Tubing: Hard-drawn seamless ASTM B-88, ASTM B-75, Type "M" and DWV as pipe size permits.
    - b. Fittings: Solder joint cast copper drainage type ANSI B-16.29.
    - c. Joints: Soldered, 95/5 tin-antimony ASTM B-828, ASTM B-32.
    - d. Flux: Non-toxic and non-corrosive, ASTM B-813.
  - C. Solder/Flux: See Paragraph 3.4 of this section for Soldering/Brazing.
- 2.4 DUCTILE IRON PIPE
- A. Pipe: Ductile iron, ANSI A-21.51, ANSI/AWWA C151.
  - B. Joints: Rubber gasket, ANSI A-21.11, ANSI/AWWA C111.
  - C. Fittings: Mechanical joint, ANSI/AWWA C110, C153 bolt tolerances – AWWA C-111, ASTM A-563.
  - D. Lining: Cement mortar, ANSI A-21.4, ANSI/AWWA C104.
- 2.5 PVC GRAVITY SEWER PIPE
- A. Pipe: Unplasticized polyvinyl chloride (PVC) with integral wall bell and spigot joints.
  - B. Material: ASTM D-3034 for SDR 35, colored green for inground identification as sewer pipe.
  - C. Joints: Two sections of pipe shall be assembled in accordance with manufacturer's recommendations and tested as per ASTM D 3212 for use with flexible elastomeric seals.
  - D. Sizes: For site drainage systems 4" to 15".
  - E. Additional compliances:
    - 1. Drop Impact Test - ASTM D-2444
    - 2. Pipe Stiffness - ASTM D-2412
    - 3. Temperature for Testing - Designed to pass all tests at 73 degrees F (+/- 3 degrees F).
- 2.6 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS
- A. Aboveground – Drainage & Vent (Sanitary) IPC Table 202.1
    - 1. ASTM D 2665
    - 2. ASTM D 2949
    - 3. CSA CAN/CSA B 181.2
    - 4. ASTM F 1488
    - 5. ASTM F-81
  - B. Underground – Drainage & Vent (Sanitary) IPC Table 702.2
    - 1. ASTM D 2665
    - 2. ASTM D 2949
    - 3. ASTM F 891
    - 4. CSA CAN/CSA-B 181.2

- C. Building Sewer Pipe (Near Water Service) IPC Table 702.3 (DWV)
    - 1. ASTM D 2665
    - 2. ASTM D 2949
    - 3. ASTM D 3034
    - 4. ASTM F 891
    - 5. CSA B182.2
    - 6. CSA B 182.4 (Ribbed Sewer Pipe & Fittings)
  - D. Fittings:
    - 1. ASTM D 3311
    - 2. ASTM D-2665
    - 3. ASTM F-1866
  - E. Solvent Cement: (All Purpose on ABS, PVC and CPVC)  
Potable Water, Sewer, Drain Waste and Vent
    - 1. ASTM D-2564, D-2235 and F-493
    - 2. CSA B137.3
    - 3. CSA B181.2 or B182.1 (Sanitary Pipe only)
    - 4. ASTM D2855
    - 5. CSA B181.1
  - F. Primers: (PVC and CPVC)
    - 1. ASTM F 656, purple color, SCAQMD Rule 1168 and OTC Regulations for VOC emission levels. NSF Standard 61 PW, DWV, Sewer.
  - G. Uniformity: To insure installation uniformity, all piping components shall be of one manufacturer.
- 2.7 CORRUGATED METAL PIPE
- A. Pipe:
    - 1. 24" diameter and smaller shall be 16 U.S. gauge steel.
    - 2. 30" diameter and larger shall be 14 U.S. gauge steel.
    - 3. All piping shall be completely bituminous coated on the interior and exterior and shall have a paved invert for 25% of its periphery.
  - B. Joints: Standard coupling bands and bolts as furnished by the pipe manufacturer.
- 2.8 VALVES (Copper Systems) – Solder ends of Threaded
- A. Valves listed below shall be for domestic water systems and comply with the latest requirements of NSF 61-8. Refer to individual sections for gas valves.
  - B. Ball Valves: NIBCO two piece, full port, 600 psi WOG rated, cold non-shock valve with reinforced TFE seals, 316 stainless steel ball, Eco-brass body, ASTM 584, Alloy C87850, solder ends, or threaded non-blowout stem design. Acceptable NIBCO figure numbers: T/S 685-80-66-LF; T/S 595-Y-66-LF (3 piece).
  - C. Check Valves: NIBCO Class 125, Eco-brass body, ASTM 584, Alloy C87850, swing type, Y Pattern, threaded cap access. Acceptable NIBCO figure number: T/S 413-LF.
  - D. Gate Valves: NIBCO Class 125, Eco-Brass body, ASTM 584, Alloy C87850, Rising Stem. Acceptable NIBCO figure number: T/S 113-LF.

- E. Balance Valves: All balance valves shall be provided with a memory stop feature with calibrated name plate to assure specific valve setting. Bronze body/brass ball, carbon filled TFE seat rings. NIBCO, Bell & Gosset, Accu-Flow, Taco or Flow Design "Accusetter". Acceptable NIBCO figure numbers: T/S 1710, F/G 737.
- F. Strainers:
1. Class 125 Bronze Y-Strainer, body to be ASTM B584 or B62 bronze with threaded, solder or female press end connections and .033 inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable Figure numbers: NIBCO Fig. S/T-221, S/T-222, PF-221/222-A,B.
  2. Class 125 Flanged Cast Iron Y-Strainer, body to be ASTM A-126 Class B cast iron. End connections to be Class 125 flanged, tapped bolted bonnet with plug. Screen shall be .033 inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable Figure numbers: NIBCO Fig. F 721-A.
  3. Class 250 Threaded Cast Iron Y-Strainer: Strainer body to be ASTM A-126 Class B cast iron. End connections to be Class 250 threaded, tapped screw-in bonnet with plug. Screen shall be .033 inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable Figure numbers: NIBCO Fig. T-751-A
- G. VALVES (Copper Systems) – Press Fit
1. Valves listed below shall be for domestic water systems and comply with the latest requirements of NSF-61-8.
    - a. 2 Inch and Smaller Ball Valves (On/Off):

Ball Valves with male or female press to connect shall be rated at 200 PSI CWP to +225°F maximum. Valves shall be manufactured in accordance with MSS SP-110 and constructed of dezincification resistant cast bronze bodies. Brass with more than 15% zinc shall not be approved. Valve shall have reinforced PTFE Seats, Blow-out Proof Stem, Full Port Ball, Chrome/Nickel Plated or Stainless Steel Ball for aggressive water.
    - b. 2 Inch and Smaller Check Valves (Swing Type):

Check valves shall be swing type Y pattern with male or female press to connect ends and shall be rated 200 PSI CWP to + 250°F maximum. Valves shall be manufactured in accordance with MSS SP-80. Body & cap shall be manufactured of dezincification resistant cast bronze ASTM B62 or ASTM B584 Alloy C8440. Valves shall have PTFE seat disc.
    - c. 2 Inch and Smaller Check Valves (Lift or Spring Type):

Incline resilient disc, spring actuated, 250psi rating, non-shock cold working pressure, 2500F maximum working temperature, bronze ASTM B584 alloy C84400. Stainless steel stem and disc holder and spring, EDPM O-ring.
- H. Insofar as possible, all valves of the same type shall be of the same manufacturer.
- I. Valve Manufacturers: Subject to compliance with requirements, provide valves of one of the following:
- Apollo/Conbraco
  - Stockham
  - Nibco
  - Milwaukee
  - Watts

Hammond

Webstone

J. System Application:

1. Domestic Water:

- a. Check Valves - 2" & Smaller - threaded or soldered.
- b. Ball Valves - 3" & Smaller - threaded or soldered.
- c. Balance Valves - All sizes - threaded.
- d. Butterfly Valves - 4" and larger - flanged.
- e. Butterfly Valves – 3" and smaller – wafer type.

2.9 THERMOMETERS

- A. Separable socket, inserted into fluid flow, adjustable, hermetically sealed, red mercury, die-cast, baked enamel finish, double strength glass lens, white scale and black graduations.
- B. Scale: Select range of thermometer to indicate normal operating temperature at mid-point of scale for domestic water systems.
- C. Manufacturer: U.S. Gauge, H.O. Trerice, Moeller, Duro.

2.10 GAUGES

- A. Phosphor bronze bourdon tube, polypropylene case, gasketed glass crystal, aluminum dial, black graduations 4-1/2 inch diameter.
- B. Range: 0 to 150 psi, 5 pound intervals, 1/2 pound graduations.
- C. Manufacturers: Danton, U.S. Gauge, H.O. Trerice, Moeller.
- D. Install with bronze gauge cock.

2.11 ISOLATING FITTINGS

- A. Furnish isolating fittings between all sections of dissimilar piping materials or piping, general supports, equipment and supports, including piping hanger and rack supports where one material is ferrous and the other is non-ferrous.
- B. Install copper or brass piping or tubing in such a way as not to touch or come in contact with ferrous metals.
- C. Where ferrous piping or equipment is connected to copper or brass piping, make connection with insulating or dielectric unions to prevent electrolytic action between the ferrous and non-ferrous metals.
- D. Where copper or brass piping, tubing or fittings are anchored to, supported by or may come in contact with ferrous metal construction, provide an insulating nonconductor spacer of rubber, fiber or equivalent material to assure prevention of electrolysis.
- E. Manufacturer: Epcos Sales, Inc., or insulated unions by Central Plastic Co.

2.12 ANCHORS AND GUIDES

- A. Anchors and guides shall be provided to support and maintain pipes in position and properly distribute expansion. The anchors and guides must be securely fastened to the building structure, and must be completely installed before the system is tested.
- B. Guides shall be as manufactured by J.J. McNally, Inc., Flexonics, Inc., Tube-Turns, American District Steam Co.

## 2.13 UNIONS

- A. Up to and including 2 inch pipe size: Screwed pattern, bronze-to-bronze seat.
- B. Above 2 inch pipe size: 125 Class Flanged pattern, A.S.A. sweat copper fitting, with gaskets, bolts and nuts.
- C. Copper tubing unions shall have sweated type ends. Flanged unions on copper tubing may be soldered connections.
- D. Materials and pressure ratings shall be the same as specified for the respective pipe and fitting system unless otherwise specified.

## PART 3 – EXECUTION

### 3.1 PIPING SYSTEM INSTALLATION REQUIREMENTS

- A. Drawings are generally diagrammatic and due to small scale, it is impossible to indicate all fittings, valves, gauges and specialties required. Provide complete operating systems and all necessary fittings, valves gauges and specialties whether or not indicated.
- B. Install all piping in accordance with the best practices of the trade and latest code requirements. Use uniform system materials throughout the building. All branch take-offs shall be off the top of the pipe.
- C. Pipe and fittings shall be clean from cutting burrs, foreign materials and defects in structure and threading. Make all cuts square. Ream after cutting. Clean off scale and dirt inside and outside, before assembly. Remove welding slag or other foreign material.
- D. Keep all piping as high as possible, consistent with proper pitch, to maintain maximum headroom. Cut piping accurately to measurements established at the building, work into place without springing, forcing or cutting of the building structure, and install as directly as possible between connecting points parallel with or at right angles to building construction, except as required to obtain pitch.
- E. Unless otherwise shown, run piping within the building, concealed in the walls, furred spaces, pipe spaces or above suspended ceilings. Unless otherwise noted, do not build in or bury horizontal piping in partitions. Install all exposed piping as closely as possible to walls, ceilings and columns, consistent with access and applicable insulation requirements.
- F. This project includes a return air plenum ceiling. Regardless of materials specified, all system piping and/or materials shall be non-combustible and shall be in full compliance with the requirements set forth in the IPC.
- G. All piping to drain to low points. Low points will be provided with drain valves with hose thread. All piping shall have high points vented with ball valve, nipple and threaded cap.
- H. Do not install trapped lines where water cannot be drained or air can accumulate without being vented.
- I. Piping shall run square with building lines.
- J. Piping shall not be insulated or covered until tested and until building is closed in.
- K. Necessary drains, off-sets, vents and drips shall be provided for coordination of the work as part of the contract.
- L. Piping shall not be installed over electrical transformers, panels, switchgear, substations, and control panels as per the National Electric Code. No piping shall be installed in elevator machine rooms unless it is directly related to the room's system equipment.
- M. Allow clearance for expansion and contraction.
- N. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.
- O. Valves shall be installed with stems above horizontal.
- P. Valves shall be installed on all sides of equipment and control valves to allow isolation for repair.

- Q. Do not support piping from other piping, conduits or equipment. Provide additional bracing to prevent movement of trapeze piping, or any singular run of pipe to fixtures. Provide additional bracing on all piping through walls to flush valves to prevent movement during normal operation or performing maintenance on valves.
- R. Thermometers and gauges shall be installed where indicated on the drawings, required by equipment specifications and where indicated elsewhere in the specifications. Gauges shall be located at an elevation that can be readable.
- S. Unions shall be provided adjacent to all valves, at equipment connections, and where necessary to facilitate dismantling of the piping system.
- T. Ball valves to be installed with the proper clearance for operating the valve handle. A minimum clearance of 10" from center of valve to wall must be maintained for ease of operation.
- U. Thermometers are to be located so they can easily be seen from the floor in front of unit. Make final adjustment by tilting thermometer. Locate bulb in waterway with an oversized tee or elbow fitting.
- V. Install pressure gauges on incoming services both domestic water and fire services. Locate pressure gauge after main shut-off valve and ahead of water meter if one is provided within building.
- W. All pipe unions installed shall be accessible. Unions shall not be concealed or located in places where they cannot be maintained.
- X. Support and bracing of 4" and above pipe shall be in accordance with the CISPI Standards and IPC Chapter 3.

3.2 TAGS, CHARTS, AND IDENTIFICATION

- A. All piping shall be labeled in accordance with IPC 303.1 and 303.4.
- B. Identify each valve in all systems with black, numbered and stamped 1-1/2" brass or aluminum tags fastened to valve by brass chain and S-hook.
- C. Piping Identification: Provide identification and safety products, semi-rigid plastic, wraparound pipe markers with flow arrows and conforming to ANSI A13.1. Locate marker at each valve, changes in direction, where pipes pass thru barriers and every 25' of horizontal runs. Lettering on background shall be in accordance with the following colors:

Legend	Background	Lettering
1. Gas	- Yellow	- Black
2. Fire Protection	- Red	- White
3. Domestic Cold Water	- Green	- White
4. Domestic Hot Water (110° ^ 140°)	- Yellow	- Black
5. Domestic Hot Water Return (110° ^ 140°)	- Yellow	- Black
6. Sanitary Drainage	- Green	- White
7. Condensate Drainage	- Yellow	- Black
8. Vent	- Yellow	- Black
9. Storm Drainage	- Green	- White

- D. Provide 1/8" scale diagrams showing location, number and service or function of each tagged item.
  - 1. Frame diagrams in approved metal frames with clear acrylic front, hinges, and locks.
  - 2. Secure to wall in Mechanical Room.
  - 3. Provide two additional separate copies permanently covered and bound.

- E. Furnish and install color coded 1” diameter markers on ceiling tile grids to indicate system and valve locations.
  - 1. Domestic cold water: - Green
  - 2. Domestic hot water: - Yellow
  - 3. Domestic hot water return: - Yellow
  - 4. Gas - Yellow
- F. Available Manufacturers: Subject to compliance with requirements, manufacturer’s offering identification markers which may be incorporated in the work are limited to the following:
  - Seton
  - Brimar
  - B-Line
  - Marking Services, Inc.

### 3.3 WELDING

- A. All concealed and inaccessible black steel piping shall be welded.
- B. All black steel piping larger than 2 inch shall be fusion welded.
- C. All elbows, tees and branch connections shall be made with welding fittings ANSI B16.9.
- D. Welding shall be in accordance with the ASME Boiler and Pressure Vessel Code Section IX.
- E. Furnish welder test certificate for review. Certificates of successful qualification by the following organizations shall be acceptable.
  - 1. ASME Boiler and Pressure Vessel Code
  - 2. ANSI Code for Pressure Piping
  - 3. National Certified Pipe Welding Bureau
  - 4. Military Specification MIL-STD-248

### 3.4 SOLDERING/BRAZING

- A. Connections between copper tubing and copper sweat fittings shall be made by soldering using Taramet Sterling or approved substitute. Flux shall be non-corrosive type “Nokorode” or approved substitute or as recommended by the manufacturer of the solder.
- B. All solder shall be “lead nickel and antimony free” in accordance with the Federal Safe Drinking Water Act Amendments of 1986 and 1996 as is ASTM B-32 Grade TC.

Composition:

Tin	95%
Copper	4.0 – 5.0%
Selenium	.04 - .2%
Tensile Strength	7,130 psi
Shear Strength	5,970 psi
Melting temperature	410°F

- C. Tubing shall be cut square and then reamed and deburred. End of tubing and inside of fitting cup shall be cleaned with steel wool and the flux shall be applied to the clean surface before soldering. After soldering, the excess solder shall be wiped off while still plastic.
- D. Brazed Joints:

1. All brazed joints shall be cleaned. An approved flux shall be applied; joint filler metal shall conform to AWS A5.8.
  2. Flux shall meet AWS Standard A5.31, Type F83-A or F83-C.
- E. 410 solder shall be used for all joints in:
1. Domestic cold water
  2. Domestic hot water
  3. Domestic hot water return
  4. Copper drainage piping
  5. Plant compressed air
- F. Lead-Tin (50-50) solder or any solder containing lead shall NOT be used or permitted for joint connections on this project.
- G. Where the silver brazing is performed in a confined non-ventilated space, a non-toxic, cadmium-free brazing alloy such as Stay-Brite shall be used instead of Easy-Flo. Bring joint to solder temperature or brazing temperature in as short a time as possible.
- H. Form continuous solder bead or brazing filler bead around entire circumference of joint.
- I. Wipe excess solder from joint area while solder is still plastic.
- J. Solder joints shall be in accordance with IPC Section 605.2, 605.14.3 and ASTM B838. Flux shall conform to ASTM B-813.
- 3.5 PRESS-FIT SYSTEM
- A. All new domestic water piping installed on this project shall be a solderless, press-fit, domestic water system. The system shall be Viega or Nibco copper press fitting system. Fittings shall be rated 0 to 250 at 200 psi and tested to 600 psi.
- B. Fittings shall meet ANSI/NSF 61, – ASME B-16.22 and ASTM B88. Elastomeric seals shall meet ASTM D-2000.
- C. Mechanical joining shall be recognized by:
- IPC International Plumbing Code
  - SBCCI Standard Plumbing Code
  - IAPMO Uniform Plumbing Code
  - PHCC National Standard Plumbing Code
- D. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). Smart Connect™ (SC Feature). In ProPress ½” to 4” dimensions, the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. This feature shall provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
- E. Press Connections: Copper press fitting joints shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- F. Installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation

of ProPress copper press joint systems. ProPress copper press fittings shall be installed using the proper tool, actuator, jaws and rings as instructed by the press fitting manufacturer. The installation of copper tubing for hot and cold water distribution systems shall conform to the requirements of the ICC International Plumbing Code or IAPMO Uniform Plumbing Code.

- G. Note: Viega ProPress or Nibco Press-fit installation shall only be permitted on this project. Push-on shark-teeth, or any type connection fittings that are not Press-Fit, shall NOT be approved.
- H. T-drill mechanically formed tee fittings shall be used in conjunction with the ProPress Copper System in accordance with the IPC Chapter 6 Section 605.5.1, 605.5.1.2 and 605.14.1. Use caution around combustible material and follow all safety guidelines for open flame during silver brazing.

END OF SECTION 22 0010



**SECTION 22 0030**  
**INSULATION & COVERING – PLUMBING**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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 DESCRIPTION OF WORK

- A. This section includes insulation and covering furnished and installed on the following piping systems and equipment:
  - 1. Domestic cold water.
  - 2. Domestic hot water supply and return
  - 3. "Primary" Horizontal rainwater conductors including underside of roof drains. "Secondary" rainwater systems insulation is not required.
  - 4. Exposed waste, trap and wall supplies at all handicap lavatories.
  - 5. Branch waste lines from all chilled water fountains.

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.
- B. Materials shall conform to the requirements of the NFPA Code.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
  - 1. Product data on all insulation and covering.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

**PART 2 – PRODUCTS**

2.1 PIPE INSULATION MATERIAL

- A. Fiberglass:
  - 1. Material: Preformed fiberglass bonded with resins to form circular pipe sleeves with factory applied, white all-service jacket bonded to reinforced foil vapor barrier jacketing. The jacket shall have factory-applied double pressure-sensitive adhesive closure and vapor sealing of longitudinal joints. Thermal Conductivity: .25 per inch at 100 degrees F. Flame spread of 25 and developed smoke of 50 or less.
  - 2. All Valves and Fittings:
    - a. Class fiber insert and premolded PVC cover, Manville "Zeston" and "Hi-Lo Temp Inserts" for valves and fittings.
    - b. Factory molded fibrous glass fitting covering for fittings.

- c. Mitered sections of pipe covering for valves.
  3. Manufacturers: Johns-Manville, Certain-Teed, Owens-Corning.
- B. Closed Cell:
1. Material: Flexible elastomeric foamed plastic closed cell structure insulation 25/50 rated with a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
  2. Flexible pipe insulation shall be a foamed plastic closed cell structure material, with a thermal conductivity of not more than 0.27 Btu/Hr./Sq. Ft./Inch at a mean temperature of 75 degrees F. The insulation shall have an average density of at least 2 pounds per cubic foot, shall be self-extinguishing, and shall have a water vapor transmission rating of not more than 0.1 perms. Between temperature limits of -40 degrees F and plus 220 degrees F, the insulation shall not indicate any deviation from its original state.
  3. Manufacturers: Armacel, Insul-Tube, Nomaco Insulation.
  4. Specification Compliance: (Latest accepted Standards and Codes)
    - IECC 804.5: Insulation thickness for domestic hot and recirculation mains.
    - ASTM-E-84 Flame spread and smoke developed.
    - NFPA 255: Standard method of test of surface burning of building materials.
    - ASTM C177: Thermal conductivity.
    - NFPA 90A, 90B: Flame & smoke rating
    - ASTM-C-534 Type 1 Tubular Grade, Self-Sealing
    - UL 181 Factory made air ducts and air connectors. (Armacell UL181 has to do with mold growth)
    - UL723 Test for surface burning characteristics of building materials.
    - ASTM G21/C1338: Fungi resistance
    - ASTM G2: Bacterial Resistance
    - ASTM D1056, 2B1: Standard spec for flexible cellular materials.
    - MIL-P-15280J, FORMT
    - MIL-C-3133B (MIL STD 670B) Grade SBE-3
    - MEA 96-85M
- C. Covering of Pipe Insulation Outdoors:
1. Wrapping: Wrap insulation with embossed .016" aluminum jacket.
  2. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.
  3. Valves and Fittings: Weatherproof all valves and fittings.
  4. Manufacturers: Johns-Manville, Certain-Teed, Owens-Corning, Knauf.
- D. Protective cover for foam insulation in wet areas indoors:
1. PVC heavy duty fitting covers and jacketing for kitchen wet areas.
  2. Fitting covers shall be glossy white, high impact, UV resistant PVC.
  3. Operating Temperature Limit: Up to 150°F.
  4. Flame Spread: 25 or less.
  5. Smoke Developed: 50 or less.
  6. Grade: Weatherable.

7. Color: White
8. Finish: Gloss
9. Fitting covers and jacketing shall be "Zeston" 300 Series PVC, heavy duty covers and "Zeston" PVC jacketing.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION**

- A. Do not install until systems have been tested and meet requirements.
- B. Do not install until building is closed in.
- C. Heavy work which may damage insulation shall have been completed in the vicinity of the insulation work.
- D. All installations shall be made by skilled craftsmen regularly engaged in this type of work.
- E. Insulation shall be continuous thru-wall, ceiling and floors.
- F. Pipe and equipment to be clean and dry prior to insulating.
- G. Install all insulation in strict conformance with manufacturer's instructions.
- H. Where "Barrier-free" lavatory supplies and waste are covered with a protective covering or insulation, the insulation must be installed back to wall, flush with wall escutcheon. Escutcheon to be finished flush with wall and wall opening to be smaller than escutcheon plate through entire building.
- I. All electrical heat tracing installations shall be coordinated with the electrical contractor. No insulation shall be installed until the heat trace wiring is completely installed, tested and approved. All insulation materials and installation work shall be the responsibility of the Insulation Contractor.
- J. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be adhered and sealed using Armaflex 520 or 520 BLV Adhesive. If when using AP Armaflex SS, only the butt joints shall be adhered using Armaflex 520 or 520 BLV Adhesive, Armaflex HT 625 Adhesive shall be used with HT Armaflex.
- K. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
- L. Tape the ends of the copper tubing before slipping the Armaflex insulation over the new pipes to prevent dust from entering the pipe.
- M. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp, non-serrated knives must be used.
- N. On cold piping, insulation shall be adhered directly to the piping at the high end of the run using a two-inch strip of Armaflex 520 or 520 BLV Adhesive on the ID of the insulation and on the pipe. All exposed end cuts of the insulation shall be coated with Armaflex 520 or 520 BLV Adhesive. All penetrations through the insulation and termination points must be adhered to the substrate to prevent condensation migration.
- O. Sheet insulation shall be used on all pipes larger than 6" IPS. Insulation shall not be stretched around the pipe. On pipes larger than 12" IPS, adhere insulation directly to the pipe on the lower 1/3 of the pipe.
- P. Seams shall be staggered when applying multiple layers of insulation.

#### **3.2 VALVES, FLANGES AND FITTINGS:**

- A. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Armaflex 520 or 520 BLV Adhesive. Screwed fittings shall be

sleeved and adhered with a minimum 1” overlap onto the adjacent insulation. Armaflex HT 625 Adhesive shall be used with HT Armaflex.

- B. Valves, flanges, strainers and Victaulic couplings shall be insulated using Armaflex donuts that shall then be covered with sheet or oversized tubular insulation.

3.3 HANGERS

- A. Support piping system using high density inserts with sufficient compressive strength. The pipe support insulation shall be elastomeric foam with the same or greater thickness than the pipe insulation. All joints shall be sealed with Armaflex 520 or 520 BLV adhesive.
- B. Standard and split hangers: Piping supported by ring hangers shall have hangers insulated with the same insulation thickness as the adjacent pipe. All seams and butt joints shall be sealed with Armaflex 520 or 520 BLV Adhesive. Armaflex HT 625 Adhesive shall be used with HT Armaflex. Ring hangers may be sleeved using oversized tubular insulation. On cold piping, insulation shall extend up the hanger rod a distance equal to four times the insulation thickness. Insulation tape may be used to a thickness equal to the adjacent insulation thickness.
- C. Clevis Hangers or other pipe support systems: Saddles shall be installed under all insulated lines at unistrut clamps, clevis hangers or locations where the insulation may be compressed due to the weight of the pipe. All piping shall have wooden dowels or blocks of a thickness equal to the insulation inserted and adhered to the insulation between the pipe and the saddle.

It is highly recommended for continuous insulation protection to use hanger sizes equal to the outer diameter of the pipe plus insulation thickness

- D. Armafix IPH o Armafix NPH can be used to prevent compression of insulation at standard split, clevis hangers or other pipe support systems. To minimize the movement of Armafix, it is recommended that a pair of non-skid pads be adhered to the clamps. In addition, to prevent loosening of the clamps, use of an antivibratory fastener, such as a nylon-locking nut, is also recommended.

3.4 PIPE COVERING (FOAMED PLASTIC TYPE)

- A. All joints and seams shall be sealed with a compatible adhesive. Approved adhesives are as follows:  
 Armacel No. 520 (Low VOC use 520 BLV  
 Benjamin Foster Company No. 85-75 up to 200 degrees F.  
 Contractor may use self-sealing insulation in lieu of above.
- B. Fitting covers shall be fabricated from the foamed plastic pipe insulation or from sheet insulation of the identical material. The fabrication shall be in accordance with manufacturer’s instructions, and all seams mitered joints shall be joined using the adhesives described.

3.5 PIPE INSULATION – TYPES & THICKNESSES

- A. Flexible Closed Cell:

Piping System	Up to 3”	Over 3” to 6”	Over 6”
Cold Water	½”	½”	¾”
Hot Water (120°)	1”	1”	1-1/2”
Hot Water Return (120°)	1”	1”	1-1/2”
Hot Water (140°)	1”	1”	1-1/2”
Hot Water Return (140°)	1”	1”	1-1/2”
Condensate Waste	½”	½”	-

Horizontal Storm (Primary)	1/2"	1/2"	3/4"
Horizontal Storm (Secondary)	----Not Required----		
Underside of Roof Drains	1/2"	1/2"	3/4"
Branch Waste From EWC's	1/2"	---	---
Handicap Lav Waste & Water	1/2"	---	---
Soil/Waste Piping Above Ceiling	1/2"	1/2"	3/4"

B. Fiberglass:

Piping System	Up to 3"	Over 3" to 6"	Over 6"
Cold Water	1/2"	1/2"	3/4"
Hot Water	1"	1"	1-1/2"
Hot Water Return	1"	1"	1-1/2"
Hot Water	1"	1"	1-1/2"
Hot Water Return	1"	1"	1-1/2"
Condensate Waste	1/2"	1/2"	---
Horizontal Storm (Primary)	1/2"	1/2"	3/4"
Horizontal Storm (Secondary)	1/2"	1/2"	3/4"
Underside of Roof Drains	1/2"	1/2"	---
Soil/Waste Piping Above Ceiling	1/2"	1/2"	3/4"

END OF SECTION 22 0030



**SECTION 22 0110**  
**DRAINAGE SYSTEMS – PLUMBING**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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 DESCRIPTION OF WORK

- A. This section includes:
  - 1. Soil and waste piping system work as indicated on drawings and schedules, and by requirements of this section.
  - 2. Applications for soil and waste piping systems include the following:
    - a. Above ground soil, waste and vent piping within buildings including soil stacks, vent stacks, horizontal branches, traps and connections to fixtures and drains.
    - b. Underground building drain piping including mains, branches, traps, connections to fixtures and drains, and connections to stacks, extension from the building, terminating at connection to site sewer.
  - 3. Storm water drainage piping as indicated on drawings and by requirements of this section.
  - 4. Applications for storm water drainage piping include the following:
    - a. Roof drains and connections to gutters, with rain water conductors and connections to underground building storm drains.
  - 5. Insulation for soil and waste and storm water drainage as specified in Section 220030 is included as work of this section.
  - 6. Trenching and backfilling required in conjunction with underground building drainage and site drainage piping as specified in Section 220000 is included as work of this section. Refer to Division I.
  - 7. Installation of detectable metallic underground tape for all exterior buried PVC drainage piping.

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section, and a listing of all applicable codes.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
  - 1. Product data on all systems equipment.
- C. See requirements for submission of cross-referencing information.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

## **PART 2 – PRODUCTS**

### **2.1 PIPING UNDERGROUND**

#### **A. Interior:**

1. Sanitary, storm water and condensate waste drainage piping within the building and extending beyond the building wall, unless otherwise noted on the plans shall be an option selection of a, b, or c below:
  - a. Service weight hub and spigot pattern cast iron soil pipe and fittings with neoprene gaskets.
  - b. Hubless cast iron soil pipe and fittings with cast iron coupling clamps and gaskets or heavy duty 3.04-.016" thick stainless steel bands..
  - c. PVC Schedule 40 pipe and fittings with solvent cement joints.

### **2.2 PIPING ABOVE GROUND**

#### **A. All above ground storm water, condensate, soil, waste and vent piping shall be:**

1. Hubless cast iron soil pipe with cast iron drainage fittings, couplings and stainless steel clamp bands for piping 2" and larger.
2. Copper tubing, type DWV with wrought copper solder type drainage fitting for piping smaller than 2" in size.

### **2.3 FLASHING**

- #### **A. All vents extending through the roof shall be flashed by the General Contractor. However, the Plumbing Contractor shall furnish and install the necessary counterflashing consisting of a Jay R. Smith Figure 1748 counterflashing fitting, or approved substitute as manufactured by Josam or Zurn. Vents shall terminate 18" above the roof.**

### **2.4 SPECIAL EXPANSION COMPENSATION**

- #### **A. Special expansion compensation products required for storm, condensate, soil and waste piping systems include the following types:**
- #### **B. Cast Iron Drainage System Expansion Joints: Cast-iron body, adjustable bronze sleeve, bronze bolts with wing nuts; for vertical installation only.**
- #### **C. Available Manufacturers: Subject to compliance with requirements. Manufacturers offering expansion joints which may be incorporated in the work include:**
1. Cast Iron Piping Systems - J.R. Smith or approved substitute.

### **2.5 SYSTEMS EQUIPMENT**

- #### **A. Refer to Plumbing Fixture and Equipment Schedule for type, number, size and manufacturer of all drainage equipment and accessories.**
- #### **B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering drainage equipment which may be incorporated in the work are limited to the following:**

#### Floor Drains (all types)

Zurn

Josam

Wade

Watts

Smith

MIFAB

Cleanouts

Zurn

Josam

Wade

Watts

Smith

MIFAB

- C. Cross Reference Identification:
1. If the Contractor selects a manufacturer of drainage equipment products other than as identified on the Schedule but is selected from the available manufacturers listed above, a cover sheet shall be included with the submission of shop drawings indicating the cross-referenced manufacturer and model number.
  2. Shop drawings shall not be reviewed or accepted if not in compliance with this requirement.

**PART 3 – EXECUTION**

**3.1 INSTALLATION OF SOIL AND WASTE PIPING**

- A. The Plumbing Contractor shall install a complete system of sanitary drainage piping as shown on the drawings. All drainage lines shall be properly run, trapped and vented in accordance with the local Plumbing Code and all dry vents, back vents, loop vents, revents or special vents required by the Code shall be furnished and installed by the Plumbing Contractor.
- B. Drainage lines of the sizes shown on the drawings shall be extended within the building with branches connecting to the base of all soil, waste and vent stack, etc., leaving outlets for connection to all fixtures, floor drains, as required.
- C. All changes in direction of drainage piping shall be installed with "Y" branches and 1/8 bends. All stacks shall be supported with concealed pipe clamps or hangers as required and the openings in the roof for the vent pipes will be provided by this Contractor.
- D. All drainage piping which will be located above suspended ceilings shall be checked for slope to assure positive drainage, prior to installation of the ceilings. Pressure tests for leaks, as hereinafter specified, shall also be performed prior to ceiling installation.
- E. Install soil and vent piping pitched to drain at minimum slope of 1/4" per foot (2%) for piping 3" and smaller, and 1/8" per foot (1%) for piping 4" and larger.
- F. Vertical to horizontal change in direction to be made with long radius fittings.
- G. Support all soil and waste piping per IPC Section 308.5, 308.6 and 308.7.

**3.2 INSTALLATION OF STORM WATER DRAINAGE PIPING**

- A. Connect piping to roof drains and outlets provided in gutters, install rainwater conductors and extend to underground storm building drains as indicated.
- B. Underground storm building drains shall be extended from the building, terminating beyond the building wall.
- C. Provide exterior clean-out on both sanitary and storm drain mains. Minimum size shall be 4" installed within 5 ft. of the building. (Also see Paragraph 3.5).
- D. Connect to exterior downspouts, install cast iron downspout shoes, and extend piping from the building wall.
- E. All changes in direction of drainage piping shall be installed with "Y" branches and 1/8 bends. All stacks shall be supported with concealed pipe clamps or hangers as required, and the openings in the

roof for the vent pipes will be provided by this Contractor.

- F. All drainage piping which will be located above suspended ceilings shall be checked for slope to assure positive drainage, prior to installation of the ceilings. Pressure tests for leaks, as hereinafter specified, shall also be performed prior to ceiling installation.
- G. Install storm water drainage piping pitched to drain at minimum slope of 1/8" per foot (1%) for piping 4" and larger.
- H. Vertical to horizontal change in direction to be made with long radius fittings.

### 3.3 INSTALLATION OF SPECIAL EXPANSION COMPENSATION PRODUCTS

- A. Expansion Joints: Install expansion joints on vertical risers as indicated, and/or as required by International Plumbing Code.
- B. PVC piping systems in multi-story (four stories or more) shall require "O" ring expansion joints to compensate for length changes in soil, waste and vent stacks. Expansion joints shall be required at every floor level for soil and waste stack and at alternate floors for vent stacks and rainwater conductors.

### 3.4 INSTALLATION OF CLEANOUTS

- A. Cleanouts: Install in sanitary piping and storm conductor and building drain piping as indicated, and/or as required by International Plumbing Code; at each change in direction of piping greater than 45 degrees; at minimum intervals of 100' for all size straight run piping; and at base of each conductor. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.
- B. Exterior cleanouts shall be installed with access covers flush to grade. The cleanout shall be installed within a concrete pad, 18"x18"x6" thick.

### 3.5 INSTALLATION OF FLOOR DRAINS (ALL TYPES)

- A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
- D. Position drains so that they are accessible and easy to maintain.

### 3.6 UNDERGROUND METALLIC TAPE

- A. All exterior underground PVC drainage piping (sanitary, storm, condensate waste) shall be provided with detectable metallic underground tape.
- B. Tape shall be similar to Lineguard Maintenance Systems as provided by Utility Supply of America 800-548-1234 or approved substitute as manufactured by Seton.
- C. Installation shall comply with manufacturer's recommendations and shall be installed in the backfill after refilling the trench opening completely, and allowed to settle to the desired 4" to 6" depth. The Contractor shall install the tape after final lifts in compaction backfilling or unroll it before final restoration or installation of sod, black dirt, seeding, etc.
- D. The tape system shall be installed under the supervision of the Owner's Representative. When the tape system is complete, the Contractor shall provide a test using the tape manufacturer's recommended detection device, to prove the integrity of the installation with the Owner's Representative.

3.7 INVERTS AND ELEVATIONS

- A. Indicated inverts and elevations of existing utilities are approximate and based on the best information available. Upon award of Contract, Contractor shall verify in the field all such information and report any discrepancies to the Engineer before proceeding with work.

3.8 PIPING INSTALLED IN FILLED GROUND

- A. Piping located below floor slab in filled areas shall be supported either from the floor slab, or with masonry piers to undisturbed earth. Drainage piping shall be supported at each joint. Exterior piping located in filled areas shall be supported with piers.
- B. Details of supports and method of installation shall meet with the approval of the Engineer.

3.9 INSPECTION

- A. The Plumbing Contractor shall, upon completion of the drainage systems, secure from the Inspector and/or the Municipality under which the installation was made and inspected, certificates or letters of approval indicating the system has been installed satisfactorily. The Plumbing Contractor shall certify that all inspection fees, permits and charges have been duly paid.

END OF SECTION 22 0110



**SECTION 22 0120**  
**DOMESTIC WATER SYSTEMS - PLUMBING**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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 DESCRIPTION OF WORK

- A. This Section includes:
  - 1. Domestic water piping systems work is indicated on drawings and schedules and by requirements of this section.
- B. Applications for water piping systems include the following:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating-water piping.
- D. Complete flow balancing of the entire domestic hot water return system.
- E. Insulation for domestic water piping as specified in Section 220030 is included as work of this section.

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
  - 1. Product data on all specialties and systems equipment.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

**PART 2 – PRODUCTS**

2.1 DOMESTIC WATER PIPING MATERIALS AND PRODUCTS

- A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in domestic water piping systems. Where more than 1 type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPE, TUBE AND FITTINGS

- A. Provide pipe, tube, and fittings complying with Division 22 Basic Materials and Methods section "Pipe, Tube, and Fittings", in accordance with the following listing:
- B. Interior Domestic Water Piping:

Tube Size 4" and Smaller: Copper tube.  
Wall Thickness: Type "L" hard-drawn temper.  
Fittings: Wrought-copper, solder-joints.

### 2.3 BASIC PIPING SPECIALTIES

- A. Provide piping specialties complying with Section 220010 Basic Materials and Methods in accordance with the following listing:

Pipe escutcheons  
Dielectric unions  
Drip pans  
Pipe sleeves  
Sleeve seals

### 2.4 SPECIAL PIPING SPECIALTIES

- A. Water Hammer Arresters: Provide bellows or piston type water hammer arresters, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.

### 2.5 BASIC VALVES

- A. Provide valves complying with applicable Division 22 sections "Valves", in accordance with the following listing:

B. Sectional Valves:

2-1/2" and Smaller: Ball Valves.  
Gate Valves.  
3" and Larger: Ball Valves.  
Butterfly Valves.

C. Shutoff Valves:

2-1/2" and Smaller: Ball Valves.  
Gate Valves  
3" and Larger: Ball Valves.  
Butterfly Valves.

D. Drain Valves:

All Hose End Threaded Gate or Ball Valves.

E. Balancing Valves:

2" and Smaller: Ball Valves (Circuit Setter Type).  
(w/ Memory Stop)

F. Check Valves:

All Sizes: Swing Check Valves. Horizontal Installations  
Spring Check Valves. Vertical Installations

### 2.6 SPECIAL VALVES

- A. Special valves required for domestic water piping systems include the following types:  
B. Hose Bibbs: Threaded end, renewable composition disc, tee handle, 3/4" NPT inlet, 3/4" hose outlet with vacuum breaker.

1. Finished Areas: Chrome plated.
2. Unfinished Areas: Bronze finish.

## 2.7 SYSTEMS EQUIPMENT MANUFACTURERS

- A. Refer to Plumbing Fixture and Equipment Schedule for type, number, size and manufacturer of all equipment and accessories.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering equipment which may be incorporated in the work are limited to the following:

### Shock Absorbers:

Zurn

Josam

Wade

Watts

Smith

PPP Inc.

MIFAB

## PART 3 – EXECUTION

### 3.1 INSTALLATION OF BASIC IDENTIFICATION

- A. Install mechanical identification in accordance with Section 220010 Basic Materials and Methods.
- B. Support vertical piping at floor levels using approved riser clamps. Clamp material shall be compatible with pipe material. Maximum vertical spacing shall be 10'-0". Domestic water piping shall be supported in accordance with the International Mechanical Code, Section 305 and Table 305.4 Spacing Intervals, or in accordance with MSS-SP-69. International Plumbing Code's latest edition, Section 308.5, accept as follows:
  1. Copper tubing ½" to 1-1/4" nominal size, not to exceed 6 ft. horizontal intervals.
  2. Copper tubing 1-1/2" and larger nominal size, not to exceed 10 ft. horizontal intervals.
  3. Copper tubing ½" to 1-1/4" nominal size, not to exceed 10 ft. vertical intervals.
  4. Copper tubing 1-1/2" and larger nominal size not to exceed 10 ft. vertical intervals.

### 3.2 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with Section 220010 Basic Materials and Methods.
- B. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

### 3.3 INSTALLATION OF VALVES

- A. Install valves in accordance with Division 22 Basic Materials and Methods section, "Valves".
- B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more fixtures, equipment connections, and elsewhere as indicated.
- C. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
- D. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.
- E. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.

- F. Balance Cocks: Install in main recirculating loop and in each branch hot water recirculating loop. Install a ball valve and check valve at each balance valve installation.
  - G. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.
- 3.4 INSTALLATION OF EXPANSION COMPENSATION PRODUCTS
- A. This project shall require the installation of expansion compensators.
  - B. Furnish and install expansion compensation products in accordance with Section 220210 Basic Materials and Methods – HVAC
- 3.5 EQUIPMENT CONNECTIONS
- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by International Plumbing Code.
  - B. Equipment furnished by the Owner or Contractors other than this Contractor: After equipment has been set in place, this Contractor shall furnish all labor and material required to make final connections, between roughing-in and the equipment. Install valves, fittings, trim and appurtenances furnished with the equipment. All exposed piping in the kitchen areas shall be chrome plated. Piping in other areas shall be of the same material as the system to which it connects.
- 3.6 SPARE PARTS
- A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.
- 3.7 DOMESTIC HOT WATER RETURN
- A. This Contractor shall install complete and operating hot water return system. The system shall be balanced and include a report as required in HVAC Specification Section 230950.
  - B. Balancing Valves are required in the system as hereinbefore specified. The system shall also include the installation of “air bleed” or “burp” valves to remove any trapped air in the system.
  - C. Where emergency showers are installed with thermostatic mixing valve, they shall require the installation of a hot water return line as detailed on the drawings.

END OF SECTION 22 0120

**SECTION 22 0140**  
**FIXTURES – PLUMBING**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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 DESCRIPTION OF WORK

- A. This Section includes:
  - 1. Plumbing fixtures and trim work as indicated by drawings and schedules, and by requirements of this section.
  - 2. Types of plumbing fixtures required for the project include the following:
    - Water Closets
    - Urinals
    - Lavatories
    - Countertop Sinks
    - Service Sinks
    - Mop Receptors
    - Electric Water Coolers
    - Sensor-Operated Flush Valves
    - Manually Operated Faucets
    - Handicap Lavatory Insulation
    - Lavatory Shield Enclosure
  - 3. Refer to Section 220120 for domestic water piping systems used in conjunction with plumbing fixtures; not work of this section.
  - 4. Refer to Section 220110 for soil and waste piping systems used in conjunction with plumbing fixtures; not work of this section.
  - 5. Refer to Division 26 sections for electrical connections to water coolers and other plumbing fixtures; not work of this section.

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.
- B. Manufacturers: Firms regularly engaged in manufacture of plumbing fixtures of the type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.
- C. Plumbing Fixture Standards: Comply with applicable portions of International Plumbing Code pertaining to materials and installation of plumbing fixtures.
- D. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.

- E. ANSI & ADA Standards: Comply with ANSI A171.1 Standard and the ADA Standard pertaining to plumbing fixtures and provisions for handicapped.
  - 1. Water closets shall measure 17" to 19" from the floor to the top of the seat. Bowls shall be elongated type.
  - 2. Flush valve mechanisms shall be on the wide side of the stall, no higher than 44" above the floor.
  - 3. Urinals shall be elongated (14" rim from the wall) mounted no higher than 17" from the floor.
  - 4. Lavatories shall be mounted no higher than 34" from the floor and provide knee clearance using an offset drain assembly with "P" trap set parallel to the fixture supporting wall. Trap and wall supplies shall be installed for clearance required for the installation of lavatory shield enclosures.
  - 5. Faucets shall be lever operated, push type, touch type, electronically operated. See Fixture Schedule. All faucets shall operate on less than 5 pounds force and shall not require tight grasping, pinching or twisting of the wrist.
- F. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.
- G. Federal Standards: Comply with applicable FS WW-P-541/- Series sections pertaining to plumbing fixtures.
- H. UL Labels: Provide water coolers which have been listed and labeled by Underwriters' Laboratories.
- I. ARI Labels: Provide water coolers which are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute Standards.

#### 1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
  - 1. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished, roughing-in dimensioned drawings, templates for cutting substrates, fixture carriers, and installation instructions.
  - 2. Color Selection Data: Submit charts or samples for color selection where applicable.
  - 3. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in maintenance manual.

#### 1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

#### 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.
- B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

### **PART 2 – PRODUCTS**

#### 2.1 PLUMBING FIXTURES

- A. Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer and as required for a complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

## 2.2 MATERIALS

- A. Unless otherwise specified, comply with applicable Federal Specification WW-P-541/-Series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with the requirements of WW-P-541/-specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps, and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541/-.
- B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, decoloration, or other surface imperfections on finished units are not acceptable.
- C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
- D. Stainless Steel Sheets: ANSI/ASTM A-167, Type 302/304, hardest workable temper. Finish: No. 4, bright, directional polish on exposed surfaces.
- E. Steel Sheets for Baked Enamel Finish: ANSI/ASTM A-591, coating Class C, galvanized-bonderized.
- F. Steel Sheets for Porcelain Enamel Finish: ANSI/ASTM A-424, commercial quality, Type 1.
- G. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes, and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ANSI/ASTM C-554.
- H. Fiberglass: ANSI Z124 smooth surfaced, with color selected by Architect/Engineer.
- I. Aluminum: ANSI/ASTM B-209/B-221 sheet, plate and extrusions, as indicated; alloy, temper and finish as determined by manufacturer, except 0.40 mil natural anodized finish on exposed work unless another finish is indicated.
- J. Synthetic Stone: High quality free from defects, glaze on exposed surfaces, stain resistant.

## 2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

- A. Lavatory Protective Shield Covers:
  - 1. Fully molded enclosure "Lav Shields" as manufactured by Zurn or Truebro, Inc., complete with tamper-resistant stainless steel fasteners.
  - 2. Shield enclosure to meet A.D.A. #4.19.4, ANSI A117.1 and BOCA P-1203.4.
- B. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting system pipes to permit outlet servicing without shut-down of water supply piping systems.
  - 1. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.
- C. P-traps: Include removable P-traps where drains are indicated for direct connection to drainage system. All traps shall be minimum 17 gauge.
- D. Carriers: Provide cast-iron and/or steel supports for fixtures. Carriers shall be provided for all wall-hung fixtures, and/or the carrier shall be selected to support the fixture independently of the wall. Carriers shall be adjustable type, complete with all fittings and foot supports. Carrier shall be single or double, back-to-back, horizontal offset and vertical stack type. Carrier shall be selected and used as best suited within the pipe chases. Where noted or indicated, stud mount type carriers shall be used and installed within stud walls 8" and less.
- E. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

- F. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated sheet steel escutcheons with friction clips.
- G. Aerators: Provide aerators of types approved by Health Departments having jurisdiction.
- H. Comply with additional fixture requirements contained in fixture schedule attached to this section.

#### 2.4 FIXTURE LIST

- A. Refer to the "Plumbing Fixture & Equipment Schedule" as indicated on the drawings.

#### 2.5 SENSOR-OPERATED FLUSH VALVES

- A. This Contractor shall furnish and install complete and operating sensor operational faucets and flush valves where so indicated and noted.
- B. The Contractor shall have a complete understanding of the sensor operated equipment and system they are installing during the bid phase of the work.
- C. The Contractor shall install the system in strict conformance with the manufacturer's written instructions. The installation shall be executed with good workmanship and to be clear of any interference with the user.
- D. The manufacturer's representative shall have at least two (2) site visits to verify that equipment and wiring are properly installed.

#### 2.6 AVAILABLE MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering fixtures, trim and carriers which may be incorporated in the work include, and are limited to the following:

##### Water Closets (Wall-Mounted Back Outlet – China)

All water closets on this project shall be maximum 1.6 gallons per flush and shall be of the pressure tank (pneumatic assisted) type with the Water Control International "WCI" System ANSI A112-19-2M and ASSE Standard 1037. Manufacturers shall be limited to the following:

All water closets on this project shall be maximum 1.6 gallons per flush, and shall be of the direct-fed siphon jet action with water control international "WCI" System, ASME A112.19.2M (and 19.6M) for vitreous china fixtures.

Zurn

American Standard

Kohler

##### Faucets/Trim (Non-Sensor Operated)

Zurn

Kohler

American Standard

Delta

Moen

Elkay

Speakman

Chicago

##### Flush Valves

Zurn

Sloan "Royal" (optima Series (Sensor-Operated))

Coyne & Delany  
ToTo  
Wall Supplies/Traps  
McGuire  
Brass-Craft  
Kohler  
American Standard  
Sanitary-Dash  
Teledyne  
Wolverine  
Pro-Flo  
Keeny  
Fixture Carriers  
Zurn  
Josam  
Wade  
Watts  
Smith  
MIFAB  
Fixture Seats  
Olsonite  
Sperzel  
Benke  
Bemis  
Church  
Kohler  
American Standard  
Centoco  
Comfort Seat  
Mop Receptors  
Fiat  
Stern-Williams  
Mustee  
Florestone  
Water Coolers  
Elkay  
Haws  
Halsey-Taylor

Oasis

Acorn

B. Cross Reference Identification:

1. If the Contractor selects a manufacturer of drainage equipment products other than as identified on the Schedule but is selected from the available manufacturers listed above, a cover sheet shall be included with the submission of shop drawings indicating the cross referenced manufacturer and model number.
2. Shop drawings shall not be reviewed or accepted if not in compliance with this requirement.

2.8 HANDICAP LAVATORY INSULATION

- A. Fully molded "P" trap and angle valve insulation kit Handi-Lav Guard Truebro Model #101, 102 and 105 to suit.
- B. Insulation to meet A.D.A. #4.19.4, ANSI A117.1 and BOCA P- 1203.4.
- C. Self-extinguishing ASTM D635 burn characteristics, Thermal conductivity ASTM C177-K value 1.17.

**PART 3 – EXECUTION**

3.1 FIXTURE CONNECTIONS

- A. Connections to plumbing fixtures shall be of the sizes indicated on the "Plumbing Fixture & Equipment Schedule".
- B. The sizes indicated on the Schedule are for drainage and water piping serving an individual fixture; the sizes of the mains and branches shall be as indicated on the drawings.

3.2 FIXTURE SETTING HEIGHTS

- A. The plumbing fixtures shall be set in accordance with the heights established by the latest edition of codes and ADA requirements.

Note: Height indicated is established as follows:

Water Closets:	From finished floor to top of seat.
Urinals:	From finished floor to rim of fixture.
Lavatories & EWC:	From finished floor to rim of fixture.
Receptor Fitting:	From finished floor to center of fitting.
Shower:	From finished floor to center of shower head.

- B. Refer to Architectural drawings and sections for fixture elevations. Fixtures in various areas may be set at lower elevations. Confirm all rough-in elevations prior to any installation.

3.3 LAVATORY PROTECTIVE SHIELD ENCLOSURES

- A. Installation shall conform to manufacturer's written instructions.
- B. All items involved with wall-hung lavatory installations shall be roughed-in and installed within the enclosure. This includes the offset "P" trap assembly, thermostatic mixing valve, sensor faucet trim and accessories, electrical outlet. Coordinate all work required for complete concealment of all devices.
- C. Protective shield enclosures are required on the toilet room's countertop lavatories and are furnished by the Architect. Coordinate all trim and accessories to fit within this enclosure.

3.4 INSPECTION AND PREPARATION

- A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other

unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until satisfactory conditions have been corrected.

- B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and service intended purposes. Comply with applicable requirements of the International Plumbing Code pertaining to installation of plumbing fixtures.
- C. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

### 3.5 CLEAN AND PROTECT

- A. Fixture shall be thoroughly cleaned after completion of installation.
- B. Protect installed fixtures from damage during the remainder of the construction period.

### 3.6 FIELD QUALITY CONTROL

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

END OF SECTION 22 0140.



**SECTION 22 0190**  
**TESTING – PLUMBING**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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 DESCRIPTION OF WORK

- A. Extent of plumbing systems to be tested is indicated on the drawings and by requirements of this section.
- B. Applications of tests include the following:
  - 1. Interior Piping
    - a. Domestic cold, hot & hot water return piping
    - b. Sanitary drainage piping
    - c. Storm water drainage piping
- D. See Fire Protection Specifications for testing of Fire Protection Systems.

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit test reports in accordance with Section 220000.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

**PART 2 – PRODUCTS**

2.1 PIPE & FITTING REPLACEMENTS

- A. Refer to Section 220010 for replacement of any defective pipe or fittings. Replacement shall include all required uncovering, excavating, recovering and backfilling.

**PART 3 – EXECUTION**

3.1 GENERAL

- A. All exterior or interior piping shall be tested and approved before backfilling or concealing. Failure to secure the approval of the Municipal Inspector, Utility Company's Inspector or the Inspector of the Architect/Engineer makes it mandatory for the Contractor to completely expose the piping for testing. All expense involved in the uncovering of the piping for the test and recovering shall be borne by the respective Contractor with no change in Contract.
- B. All equipment, material and labor required for testing a plumbing system or part thereof shall be furnished by the Plumbing Contractor responsible for installing the work.

3.2 INTERIOR PIPING

- A. Drainage Piping:

**Rough Plumbing:** The piping of all plumbing storm, condensate waste, sanitary drainage and venting systems shall be tested upon completion of the rough piping installation by water or air and proved watertight. Where required by the code official, the cleanout plugs shall be removed to ascertain if the pressure has reached all parts of the system. Either of the following methods shall be used:

1. **Water Test:** The water test shall be applied to the drainage system either in its entirety or in sections after rough piping has been installed. If applied to the entire system, all openings in the piping shall be closed, except the highest opening, and the system filled with water to the point of overflow. If the system is tested in sections, each opening shall be plugged except the highest opening of the section under test, and each section shall be filled with water, but a section shall not be tested with less than a 10-foot head of water.

In testing successive sections, at least the upper 10 feet of the next preceding section shall be tested, so that a joint or pipe in the building (except the uppermost 10 feet of the system) shall not have been subjected to a test of less than a 10-foot head of water. The water shall be kept in the system or in the portion under test for a minimum of 15 minutes before inspection starts. The system shall then be tight at all points.

2. **Air Test:** The air test shall be made by attaching an air compressor testing apparatus to an opening, and, after closing all other inlets and outlets to the system, forcing air into the system until there is a gauge pressure of 5 pounds per square inch (5 psi) or a minimum of 10-inch column of mercury. This pressure shall be held without introduction of additional air for a minimum period of 15 minutes.

Precautionary Note: The compressibility of air and/or other gases result in tremendous amounts of stored energy, even at lower pressures. Over-pressurizing creates a substantial hazard to personnel and property near the area should a failure occur. Consult with the Plastic Pipe Institute (PPI) for statements and alerts, along with State and local safety offices.

**Finished Plumbing:** Where required by the code official, after the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight by one of the following test methods.

1. The final test for gas and water-tightness of the completed drainage and vent systems shall be made by a smoke test or other approved method. The test shall be made by filling all traps with water, and then introducing into the system smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1" water column shall be built and maintained for the period of the inspection.
2. After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proven gas and water-tight by plugging the stack openings on the roof and building drain where the drain leaves the building and with air introduced into the system equal to the pressure of a 1-inch water column. This shall be accomplished by the use of a "U" tube or manometer inserted in the trap of a water closet. Such pressure shall remain constant for the period of inspection without the introduction of additional air.

**Building sewer test:** The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer or individual sewage disposal system. The building sewer shall then be filled with water under a head of not less than 10 feet. The water level at the top of the test head of water shall not drop for at least 15 minutes.

- B. **Domestic Water Piping:** All new, altered, extended or replaced interior water piping installed shall be tested at 100 psig maintaining the pressure for four hours with not more than 1% drop in pressure. The system shall be filled with water which shall remain in the system until the water and the piping are the same temperature. If water pipe testing is under the jurisdiction of the local inspector, his

requirements shall be used; however, they shall be not less than specified herein. The tests shall be performed in the presence of the representative of the Architect/Engineer and to his satisfaction.

### 3.3 STERILIZATION

- A. After final testing for leaks, all new potable water piping installed including water service piping, shall be flushed to remove foreign material.
- B. Before placing domestic water systems in service, a qualified service organization shall be engaged, to sterilize the entire building including the exterior water service piping in accordance with the following procedure:
  - 1. Contractor shall provide a 3/4" hose connection somewhere in the main entering the building, or in the Mechanical Room and/or in the meter pit, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 100 PPM.
  - 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. Consult with the local code department for additional concentrations and durations.
  - 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 hours.
  - 4. At the end of the retention period, no less than 100 PPM of chlorine shall be present at the extreme end of the system.
  - 5. 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.
  - 6. Obtain representative water samples from the system for analysis by a recognized Bacteriological Laboratory.
  - 7. If all samples tested for impurities and organisms are negative, a letter and laboratory reports shall be submitted by the service organization to the contractor, certifying successful completion of the sterilization.
  - 8. If any samples tested indicate the presence of harmful impurities and organisms, the entire sterilization procedure shall be repeated.
  - 9. Plumbing Contractor shall provide plumbing connections and power for pumping chlorine solution into the system.

Warning: PVC and CPVC Pipe: Do not use a dry granular calcium hypochlorite as a disinfecting material for water purification in potable water piping systems. The introduction of granules or pellets of calcium hypochlorite with solvent cements and primers (including their vapors), may result in violent chemical reactions.

- C. Available Service Organizations: Subject to compliance with requirements, provide the sterilization service of one of the following:

Water Chem

Arc Company, Inc.

Nova Consultants

Artesian Water Co.

END OF SECTION 22 0190



**SECTION 22 0191**  
**BALANCING – PLUMBING**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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 DESCRIPTION OF WORK

- A. Extent of plumbing systems to be balanced is indicated on the drawings and by requirements of this section.
- B. Applications of tests include the following:
  - 1. Interior Piping
    - a. Domestic hot water and hot water return

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit balancing report in accordance with Section 220000.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

**PART 2 – PRODUCTS**

2.1 PIPE & FITTING REPLACEMENTS

- A. Refer to Section 220010 for replacement of any defective pipe or fittings. Replacement shall include all required draining of system, removal and replacement and uncovering, recovering.

**PART 3 – EXECUTION**

3.1 GENERAL

- A. All new hot water return piping installed or wherever system valves are being replaced, the system shall be tested, balanced and approved before concealing. Failure to secure the approval of the Municipal Inspector, A/E Inspector or the Inspector of the Owner makes it mandatory for the Contractor to completely expose the piping for balancing. All expense involved in the uncovering of the piping for the balancing and recovering shall be borne by the respective Contractor with no change in Contract.
- B. All equipment, material and labor required for balancing a plumbing system or part thereof shall be furnished by the Plumbing Contractor responsible for installing the work.

3.2 INTERIOR PIPING

- A. Domestic Hot Water Return System: Upon completion of the testing of the domestic hot water supply and recirculation systems, a final procedure is to be performed to obtain uniform circulation within each hot water loop of the domestic hot water system. At the ends of the hot water mains, or wherever a branch return line connects to the main return line, there shall be three (3) valves: ball valve, check valve and balancing valve. These valves are to be installed in an accessible space at/or above the

ceiling or where indicated on the drawings.

- B. Based on an Accu-Flo balancing valve, the use of a differential pressure gauge Model No. 779 shall be used to achieve the greatest accuracy.

END OF SECTION 22 0191

**SECTION 23 0200**  
**GENERAL PROVISIONS – HVAC**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

- A. 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 work of this Section.
- B. This specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.
- C. All Mechanical Systems shall be part of and included in all of the following: 230200 thru 230950.

**1.2 WORK INCLUDED**

- A. Provide labor, materials, equipment and supervision necessary to install complete operating HVAC Systems, including all work at the site and within the proposed construction areas to accomplish the required work.
- B. Wherever the term "provide" is used, it shall be understood to mean both "furnish" and "install".

**1.3 REGULATIONS, CODES AND STANDARDS**

- A. Work shall be performed in accordance with latest adopted codes, regulations and ordinances by authorities having jurisdiction. Observe all safety regulations.
- B. Obtain all permits and inspection certificates and pay all charges.
- C. Latest editions of any referenced standards shall govern.

**1.4 RELATED WORK**

- A. Refer to equipment shown or specified in sections of Division 1 thru 14 and 26 that will require Mechanical services and provide such service.
- B. Refer to work related to HVAC as shown on the following contract drawings:
  - Architectural & Structural
  - Plumbing
  - Electrical
- C. This Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical.

**1.5 COORDINATION**

- A. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed. Any necessary changes required will be included as part of this contract.
- B. Mechanical Contractor shall coordinate scheduling, submittals and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of independent work elements, with provisions to accommodate items that may be installed at a later time.
- C. Mechanical Contractor shall verify utility requirements and all characteristics of operating equipment are compatible with the building utilities. Coordinate the work of all sections related and required for

installing, connection and placing in service of all equipment.

- D. Mechanical Contractor shall coordinate all space requirements, supports and installation of all mechanical, electrical, plumbing and fire protection work, which are indicated diagrammatically on the Drawings. Verify routing of all pipes, ducts, conduits and equipment connections. Maximize accessibility for other work, and service requirements for maintenance and repairs.
- E. Obtain written confirmation from all related trade Contractors and the Owner or his representative that requirements, conflicts and coordination issues have been discussed and resolved.
- F. Submit coordination drawings to verify access and clearances.

#### 1.6 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations..
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installation within unheated shelters.

#### 1.7 SUBMITTALS

- A. Shop Drawings:
  - 1. Shop drawings shall be submitted in accordance with Division 1 of these specifications except where herein modified.
  - 2. Shop drawings comprising complete catalog cuts, performance test data for HVAC equipment as required by other sections of Division 23, shall be submitted for review checking. The Contractor shall review these shop drawings for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, samples and similar materials, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the requirements contained in the contract documents for the work of all trades.
    - a. The Contractor and equipment manufacturer shall clearly indentify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents.
    - b. The Contractor shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.
  - 3. All shop drawing submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto.
    - a. Project name.
    - b. Project number.

- c. Sub-contractor's, vendor's and/or manufacturer's name and address.
  - d. Product identification.
  - e. Identification of deviation from contract documents.
  - f. Applicable contract drawings and specification section number.
  - g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
4. Resubmit revised or additional shop drawings as requested.
  5. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the contractor making the submission to identify by name, the contractor who is to do this work. If the contractor named is other than the contractor making the submission, the shop drawing submission must be reviewed by the named contractor and bear his mark of approval, prior to submission to the Architect/Engineer.
  6. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.
  7. The Contractor shall keep one copy of approved shop drawings at the job site,, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.
  8. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.
- B. Contractor is responsible for the shop drawing coordination and interface with the work of other contracts and adjacent work. The relationship of Contractor's work shall be verified as it relates to adjacent and critical features of the work of this and all contracts and materials.
  - C. The Contractor shall submit a complete schedule of all shop drawings required for the scope of work covering all materials and equipment listed in all sections of Division 23, Mechanical, including all documents required for contract closeout, Owner instructions and training, and all turnover items at the completion of the work. This schedule shall be submitted for review and approval within thirty days of contract award and before any subsequent materials are provided for review.
  - D. The shop drawings provided by the Contractor will be reviewed only once and resubmittals will be reviewed only once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

#### 1.8 SITE INSPECTION

- A. The Contractor shall visit site, inspect, and become aware of all conditions which may effect the work during the estimation phase of his work prior to bid openings. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of a bid will be deemed evidence of having complied with this requirement.

#### 1.9 SUBSTITUTIONS

- A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.
- B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the Contractor or an equipment vendor to deviate from the written portion of the specifications unless so stated in the addendum.
- C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.

- D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to all: space requirements, code clearances, type-horsepower-capacities-number and size of services required from other trades including all auxiliary items provided by this Contractor and all other trades, and all manufacturer's specific equipment applications standards and requirements, for approved equipment including that which is basis of design or a substitution. The bidding related contractor and equipment manufacturers shall clearly identify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents. If the bidding contractor or manufacturer does not comply with these requirements then they shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.

1.10 LUBRICATION

- A. Provide and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.
- B. Provide one year's supply of lubricants to Owner at date of acceptance.
- C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 EQUIPMENT START-UP

- A. Verify proper installation by manufacturer or his representative.
- B. Advise General Contractor 2 days prior to actual start-up.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.
- D. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.
- E. The Mechanical Contractor shall own as part of his work, the following:  
Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

1.12 OPERATION & MAINTENANCE INSTRUCTIONS

- A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.
  - 1. Provide two (2) 4-hour sessions of training to School District/Owner's Maintenance Staff.
- B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each system as a whole.
- D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.
- E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, complete schedule of air filters for each unit type in Excel spreadsheet format, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
- F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.

- G. Provide to the Owner any special tools necessary for operation and routine maintenance of any of the equipment.
- H. Upon completion of the project, the Mechanical Contractor shall provide a complete set of legible as-built drawings for the Owner.
- I. Furnish three (3) copies of a professionally taped video and three (3) copies of professionally prepared drawings demonstrating the following:
  - Locations of main shut-off valves.
  - Procedures for equipment start-up and seasonal shut-downs.
  - Procedures for maintenance.
  - Provide written version of all procedures included in video.

The above should cover all equipment/systems including, but not limited to, the following:

- Hot water distribution system.
- Chilled water distribution system.
- Air handlers
- Energy recovery unit
- Fans
- D/X cooling units
- ATC System

#### 1.13 TOOLS

- A. All equipment furnished by the Mechanical Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Mechanical Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

#### 1.14 CLEANING AND FINISHING

- A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.
- B. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.
- C. All fixtures, piping, finished surfaces and equipment shall have all grease, adhesive labels and foreign materials removed.
- D. All piping shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation ten (10) days.
- E. When connections are made to existing systems, the Mechanical Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.
- F. Clean-up: Remove from the premises, all unused material and debris resulting from the performance of work under this section.

## **PART 2 – PRODUCTS**

### **2.1 GENERAL**

- A. All material and equipment shall be new and of present day manufacture, and shall conform to accepted standards of the trade where such a standard has been established for the particular type of equipment or material.
- B. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed to apply to as many such items as necessary to complete the work.

### **2.2 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. During loading, transporting and unloading exercise care to prevent damage to material.
- B. Store all materials in dry enclosures or under protective coverings out of way of work progress.
- C. Material shall not be allowed to be stored directly on ground.
- D. Deliver in manufacturer's original cartons or on skids.
- E. Handle and protect so as to prevent damage to product or any surrounding material.

### **2.3 WARRANTY**

- A. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Mechanical Contractor under the contract documents.

## **PART 3 – EXECUTION**

### **3.1 PROTECTION**

- A. Plug or cap open ends of piping systems, conduit and ductwork.
- B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.
- C. Protect all installed work until accepted in place by the Owner.
- D. Plates, polished metal escutcheons, thermostats and other finished devices shall not be installed until masonry, tile, and painting operations are complete unless otherwise protected.
- E. Protect all work from operations which may cause damage such as hauling, welding, soldering, painting, insulating and covering.

### **3.2 WORKMANSHIP**

- A. Install all work neat, trim and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.
- D. This Contractor shall provide a complete weathertight seal to all new systems in the building including the necessary caulking, weather-stripping and insulation.

### **3.3 EQUIPMENT SETTING**

- A. Provide as a minimum, a 4 inch concrete pad beneath all floor-mounted equipment. Install anchor bolts in pour.
- B. Provide as a minimum, spring vibration isolation under any equipment 10 HP and over and rubber in shear vibration isolation on any equipment up to 10 HP. For further specifications and additional requirements, refer to other sections.
- C. Concrete shall be 3,000 psi, 28 day compressive strength in accordance with ACI-613. Reinforce with No. 4 rod 12" on centers both ways or as otherwise detailed.

### 3.4 FASTENERS, HANGERS AND SUPPORTS

- A. Provide all hangers and supports required to suspend, mount, or hang the work.
- B. Provide all miscellaneous steel angles, channels, beams, clips, brackets and anchors necessary to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded more than 1/4 rated capacity.
- E. Power-driven fasteners shall not be allowed for piping larger than 2 inch, or equipment. When used they shall not be loaded more than 1/8 rated capacity or 200 pounds.
- F. All hangers, miscellaneous steel, braces and supports shall be galvanized, cadmium plated, or primed steel. Copper tubing shall be supported with copper hangers.
- G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles or pipe shields in accordance with piping support spacing table on the drawings. Where hangers are 18" or longer provide lateral bracing at every fourth hanger.
- H. Support vertical piping at floor levels. Piping shall have split rings.
- I. Any lintels required for openings for this work if not indicated on Architectural or Structural drawings shall be provided under this Section.

### 3.5 SLEEVES

- A. Provide each pipe, duct or conduit passing through a masonry or concrete wall, floor or partition with a sleeve made from standard weight steel pipe for pipe or conduit and No. 12 gauge galvanized steel for ducts, with smooth edges, securely and neatly cemented in place. Provide each pipe, duct or conduit passing through a frame or metal partition with a sleeve made from No. 22 gauge galvanized sheet metal, securely fastened in place.
- B. Be responsible for the proper location and alignment of all sleeves.
- C. Provide hydrostatic seals for sleeves passing through outside walls, either above or below grade, or through hydrostatically sealed slabs or floors on grade. Provide fire-rated seals for all sleeves which penetrate fire-rated walls.
- D. Install both piping and sleeve seals so as to maintain integrity of seals with expansion and contraction of piping.
- E. Set floor sleeves flush with floor surface in finished areas, 1" above the finished floor in kitchens, cafeterias, and similar service areas unless such areas are slab-on-grade; 1" above the floor in mechanical rooms, pipe chases, pipe spaces and other unfinished areas, unless otherwise indicated, and flush with the underside of slabs. Extend wall and partition sleeves through and cut flush with each surface unless otherwise indicated or specified.
- F. Select sleeves two pipe sizes larger than any pipe or conduit that is to remain uncovered, unless otherwise required by the sealing method specified. Where pipes are to be covered, provide sleeves large enough to allow the covering to pass through the sleeves with sufficient clearance for sealing as specified hereinafter. Size sleeves for branch piping from vertical risers large enough to permit vertical expansion at the riser.
- G. Select duct sleeve sizes to suit requirements of fire dampers and sealing methods as specified.
- H. Place sleeves imbedded in concrete floors or walls in the forms before concrete is poured; sleeves shall have integral waterstop flanges, where they are to receive either watertight or hydrostatic seals.
- I. Install sleeves passing through above-grade floors of mechanical rooms, toilet rooms, kitchens or similar service areas where liquid leaks or spillover may occur in a watertight manner. Sleeves shall be such that waterproofing membrane can be flashed around and into the sleeve where necessary.

- J. Hydrostatic Sealing Method: Provide compressible synthetic rubber seals, equivalent to LINK SEAL, manufactured by the Thunderline Corporation, or THRUWALL manufactured by O.Z. Gedney. Install seals in accordance with the manufacturer's recommendations to provide air tightness aboveground and hydrostatic sealing belowgrade. Caulking or other type mastic is not acceptable.
  - K. Fire-Rated Sealing Method:
    - 1. Sleeves, openings and sealants shall comply with applicable codes, recommended practices and standards, and manufacturer's instructions. Fire sealants shall have ability to prevent spread of flame, smoke or water throughout the penetration and shall pass 3-hour test, UL test ASTM E814 and UL 1479.
    - 2. Products: Chase Corporation CTC PR-855, O. Z. Gedney CRS/CAFS, 3M Electro-Products Division Putty 303 or Caulk CP25 penetration sealing kits, General Electric Company sealants type RTV-850, 6428 or 7403, Hilti FS-one, Thunderline Corporation "Link-Seal Pyro-Pak". Installation and type of sealant to be used as recommended by the manufacturer.
- 3.6 PLATES
- A. Provide chrome plated plates wherever piping passes into finished area.
  - B. Plates shall be securely fastened to piping or building construction.
  - C. Floor plates shall cover 1 inch sleeve extension.
- 3.7 OFFSETS, TRANSITIONS, MODIFICATIONS
- A. Provide all offsets necessary to install the work and to provide clearance for other trades.
  - B. Maintain adequate headroom and clearance.
  - C. Incidental modifications necessary to the installation of the systems shall be made as necessary and as approved by the Architect.
- 3.8 RECESSES
- A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, and other equipment or devices which are to be recessed in walls.
  - B. Make offsets or modifications as required to suit final locations.
- 3.9 LABELING
- A. All HVAC equipment such as pumps, fans, air handling units, and devices requiring identification for operating procedures shall be provided with permanent black laminated micarta white core labels with 3/8 inch letters.
  - B. This shall also apply to all controllers, remote start/stop pushbuttons and equipment cabinets.
  - C. This shall not apply to individual room thermostats.
  - D. At all fire damper, smoke damper and combination fire/smoke damper locations, access doors in ductwork shall be identified with a permanent placard of red-white-red laminated commercial grade plastic construction, minimum one-half inch high capital letters, reading, "FIRE DAMPER", "SMOKE DAMPER", "FIRE/SMOKE DAMPER" as appropriate for the installation. Attach securely to face of access door with brass screws at each corner, sealed airtight.
- 3.10 FLASHING AND COUNTERFLASHING
- A. Roof curbs, etc., shall have counterflashing fittings. General Contractor shall provide flashing.
  - B. Piping and conduit thru the roof shall be flashed by the General Contractor. Provide counterflashing.
  - C. Provide curbs with base features required to match roof materials, finishes and configuration; e.g., flat, sloped, raised seam, etc.

3.11 ACCESS

- A. Locate all equipment, valves, devices and controllers which may need service in accessible places.
- B. Where access is not available, access panels shall be provided. Furnish access panels to the General Contractor for installation.
- C. Access panels shall be Nailor-Hart Industries, Karp Co., or Controlled Air Manufacturing Limited, with 16 gauge frames and 14 gauge steel door, prime painted.
- D. Maintain access clearances for tube or fan removal, coil pulls, and filter removal.

3.12 WIRING AND MOTOR CONTROLS

- A. Packaged equipment shall be furnished with disconnect switches, starters, overloads, factory furnished and wired by the unit manufacturer.
- B. Roof-mounted exhaust fans, except utility sets, rated less than 1/2 HP at 115 volts, single phase, shall be furnished with disconnect switches, factory furnished and wired by unit manufacturer.
- C. Rooftop equipment shall be furnished with starters, disconnect switches, overloads, factory furnished and wired by unit manufacturer.
- D. This Contractor shall furnish all information and assistance required for the Electrical Contractor to purchase all motor starters that are not specified to be part of the mechanical equipment.
- E. Control wiring shall be provided under this Division of the work.
- F. All wiring shall be in accordance with the National Electrical Code and as recommended by the equipment manufacturer.

3.13 UTILITIES

- A. Do not interrupt any utility or service to the Owner without adequate previous notice and schedule.

3.14 OPENINGS - CUTTING, REPAIRING

- A. This Contractor shall cooperate with the work to be done under other sections in providing information as to openings required in walls, slabs and footings for all piping, ductwork and equipment, including sleeves where required.
- B. Any drilling or cutting required for the performance of work under this Section, shall be the responsibility of this Contractor and the cost thereof shall be borne by him.
- C. Holes in Concrete: Sleeves shall be furnished, accurately located and installed in forms before pouring of concrete. This Contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drilled or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling.
- D. It shall be the responsibility of this Contractor to ascertain that all chases and openings are properly located.

3.15 PAINTING

- A. The General Contractor shall be responsible for painting.

3.16 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the Owner.
- B. Guarantee shall be extended on an equal time basis for all non-operational periods due to failure within the guarantee period.
- C. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of one year from date of acceptance of the work by the Owner unless otherwise specified in Division 1. Should any trouble develop during this period due to defective

materials or faulty workmanship, the Mechanical Contractor shall furnish necessary labor and materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

- D. In the event of occupancy by the Owner prior to final acceptance of the project, the guarantee date for equipment placed in operation shall be mutually agreed to by the Mechanical Contractor and the Owner's representative.

### 3.17 DRAWINGS

- A. The Mechanical Systems are indicated on the Contract Drawings. Certain pertinent information and details required by the Mechanical Work appear on the Architectural, Structural and Electrical Drawings; become familiar with all drawings, and incorporate all pertinent requirements.
- B. Drawings are diagrammatic and indicate the general arrangement of systems and requirements of the work. Do not scale drawings. Exact locations of fixtures and equipment, not specifically shown, shall be obtained before starting work.

### 3.18 TESTING AND BALANCING OF MECHANICAL EQUIPMENT

- A. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.
- B. The Mechanical Contractor shall own as part of his work, the following:  
Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION 23 0200

**SECTION 23 0210**  
**BASIC MATERIALS AND METHODS – HVAC**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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.
- B. Refer to Section 230200 for HVAC General Provisions.
- C. Refer to other sections in Division 23 for materials and methods not specified herein.

1.2 DESCRIPTION OF WORK

- A. Included in this Section are the following:
  - 1. Steel Pipe and Fittings
  - 2. Copper Tubing & Fittings
  - 3. Strainers
  - 4. Thermometers
  - 5. Gauges
  - 6. Test Stations - Pressure/Temperature
  - 7. Isolating Fittings
  - 8. Pipe Saddles
  - 9. Anchors and Guides
  - 10. Expansion Compensators or Expansion Joints
  - 11. Unions
  - 12. Motors

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. Install work to meet the requirements of the following:
  - 1. New Castle County Dept. of License and Inspections
  - 2. International Mechanical Code
  - 3. Gas Utility Company
  - 4. NFPA
  - 5. OSHA
  - 6. ASHRAE
  - 7. Manufacturer's Standardization Society (MSS) of the valve and Fittings Industry, Inc.:
    - SP-58 Pipe Hangers and Supports Materials, Design and Manufacture.
    - SP-69 Pipe Hangers and Supports Selection and Application
- C. Appliances and materials governed by UL requirements shall meet such requirements and bear the label.

#### 1.4 QUALITY ASSURANCE

- A. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.
- B. Verify that all work and equipment is installed in accordance with manufacturer's warranty requirements.

### PART 2 – PRODUCTS

#### 2.1 STEEL PIPE AND FITTINGS

- A. Water Piping:
  - 1. ASTM A53, Schedule 40.
  - 2. Fittings up to 2 inch shall be 150 lb. malleable iron, screwed pattern ASME B16.3. Butt weld , ASME B16.9, same thickness as pipe.
  - 3. Fittings 2-1/2" and larger shall be butt weld ASME B16.9, same thickness as pipe.
  - 4. Weld-O-Lets and Thread-O-Lets shall be maximum of two sizes smaller than main size; i.e., maximum of a 2-inch Weld-O-Let on a 3-inch pipe.
  - 5. Thread tape shall be teflon tape, 3 mils minimum thickness.

#### 2.2 COPPER TUBING & FITTINGS

- A. Refrigeration Piping:
  - 1. Copper tubing: Type ACR, hard drawn temper.
  - 2. Fitting: Wrought-copper, solder joints, ASME B16.22 or ASME B16.26.
  - 3. Joints: Brazed, American Welding Society (AWS) Class BCUP-5 for brazing filler metal.
- B. Water Piping:
  - 1. Tubing: Hard drawn seamless ASTM B-88 Type "L" aboveground.
  - 2. Soft seamless ASTM B-88 Type "K" below-ground.
  - 3. Joint Material: Brazed joints, low temperature silver-bearing solder.
    - a. Flux shall be non-toxic type and non-corrosive.
- C. Condensate Drain Piping:
  - 1. Pipe: Copper tubing Type DWV.
  - 2. Fittings: Wrought copper solder type drainage fittings, ASME B16.23 or B16.29.

#### 2.3 STRAINERS (WATER)

- A. Perforations: .033" pipe size to 2", .057" pipe size 2-1/2" to 4", 1/8" pipe size 6" and up.
- B. Self-cleaning "Y" type screwed end up to 2 inch with machined seats with blow-off outlet, stainless steel screen, iron body.
- C. Self-cleaning "Y" type flanged 2-1/2 inch and up, with bolted cover flange, blow-off outlet, 125 psi ANSI, brass screen.
- D. Manufacturer: Muesco, Sarco, Hoffman Specialties, Metraflex, Armstrong, Watson McDaniel.

#### 2.4 THERMOMETERS

- A. Separable socket, inserted into fluid flow, adjustable, hermetically sealed, red or blue indicating fluid, non-toxic, die-cast, baked enamel finish, double strength glass lens, white scale and black graduations.
- B. Scale: Heating Water - 30 deg. to 240 deg. F  
Chilled Water - 0 deg. to 100 deg. F

- C. Manufacturer: U.S. Gauge, H.O. Terrice, Moeller, Duro, Miljoco Corp., Winter Instruments.

## 2.5 GAUGES

- A. Phosphor bronze bourdon tube, polypropylene case, gasketed glass crystal, aluminum dial, black graduations 4-1/2 inch diameter.
- B. Range: 0 to 60 psi, 5 pound intervals, 1/2 pound graduations.
- C. Install with bronze gauge cock.
- D. Manufacturers: Danton, U.S. Gauge, H.O. Terrice, Moeller, Miljoco Corp., Winter Instruments, Weksler Instruments.

## 2.6 ISOLATING FITTINGS

- A. Provide isolating fittings between all sections of dissimilar piping materials or piping and equipment where one material is ferrous and the other is non-ferrous.
- B. Manufacturer: Epcos Sales, Inc., or insulated unions by Central Plastic Co.

## 2.7 PIPE SADDLES

- A. Steel pipe saddles shall be welded to all black ferrous pipe, 2-1/2" pipe size and larger, at hanger locations, for systems of steam, hot water and other heat conveying systems.
- B. Steel pipe saddles shall be welded to all black ferrous hot piping at the pipe support location when roll type hangers or pipe roll supports are employed.
- C. The saddles shall be packed with plastic insulating cement, and the saddle shall finish flush with the surface of the specified insulation.

## 2.8 ANCHORS AND GUIDES

- A. Anchors and guides shall be provided to support and maintain pipes in position and properly distribute expansion. The anchors and guides must be securely fastened to the building structure, and must be completely installed before the system is tested.
- B. Factory made cast semi-steel or fabricated steel, consisting of a bolted two-section outer cylinder and base with two-section guiding spider bolted or welded tight to the pipe.
- C. Guide and spider shall be of sufficient size to clear pipe insulation and long enough to prevent over travel of spider and cylinder. Guides shall not be used as pipe supports.
- D. Guides shall be as manufactured by J.J. McNally, Inc., Flexonics, Inc., Metraflex, Hyspan, Twin City Hose, Inc.

## 2.9 UNIONS

- A. Up to and including 2 inch pipe size: Screwed pattern, bronze-to-bronze seat.
- B. Above 2 inch pipe size: Flanged pattern, A.S.A. forged steel, with gaskets, bolts and nuts.
- C. Copper tubing unions shall have sweated type ends. Flanged unions on copper tubing may be soldered connections.
- D. Materials and pressure ratings shall be the same as specified for the respective pipe and fitting system unless otherwise specified.

## 2.10 MOTORS

- A. All single phase and polyphase motors shall be manufactured to incorporate the latest NEMA standards.
- B. All single phase and polyphase motors shall have steel frames with ball bearings and copper windings. All motors to have a Class "F" insulation system with a service factor of 1.15.

- C. All motors shall be 1725 RPM, 4 pole design, unless otherwise noted on the drawings, or in the equipment specifications.
- D. Motors installed indoors and not exposed to moisture shall be open, dripproof, Class B temperature rise based on 40 deg. C maximum ambient temperature.
- E. Motors installed outdoors and exposed to moisture shall be totally enclosed, fan cooled, Class B temperature rise based on 40 deg. C maximum ambient temperature.
- F. Based on NEMA Standards, motors shall comply with the following minimum nominal efficiencies at full load.

<b>Nominal Efficiencies for “NEMA Premium™” Induction Motors</b>						
<b>Rated 600 Volts or Less (Random Wound)</b>						
	<b>Open Drip-Proof</b>			<b>Totally Enclosed Fan-Cooled</b>		
<b>HP</b>	<b>3500 RPM</b>	<b>1800 RPM</b>	<b>1200 RPM</b>	<b>3500 RPM</b>	<b>1800 RPM</b>	<b>1200 RPM</b>
<b>1</b>	<b>82.5</b>	<b>85.5</b>	<b>77.0</b>	<b>82.5</b>	<b>85.5</b>	<b>77.0</b>
<b>1.5</b>	<b>86.5</b>	<b>86.5</b>	<b>84.0</b>	<b>87.5</b>	<b>86.5</b>	<b>84.0</b>
<b>2</b>	<b>87.5</b>	<b>86.5</b>	<b>85.5</b>	<b>88.5</b>	<b>86.5</b>	<b>85.5</b>
<b>3</b>	<b>88.5</b>	<b>89.5</b>	<b>85.5</b>	<b>89.5</b>	<b>89.5</b>	<b>86.5</b>
<b>5</b>	<b>89.5</b>	<b>89.5</b>	<b>86.5</b>	<b>89.5</b>	<b>89.5</b>	<b>88.5</b>
<b>7.5</b>	<b>90.2</b>	<b>91.0</b>	<b>88.5</b>	<b>91.0</b>	<b>91.7</b>	<b>89.5</b>
<b>10</b>	<b>91.7</b>	<b>91.7</b>	<b>89.5</b>	<b>91.0</b>	<b>91.7</b>	<b>90.2</b>
<b>15</b>	<b>91.7</b>	<b>93.0</b>	<b>90.2</b>	<b>91.7</b>	<b>92.4</b>	<b>91.0</b>
<b>20</b>	<b>92.4</b>	<b>93.0</b>	<b>91.0</b>	<b>91.7</b>	<b>93.0</b>	<b>91.0</b>

- G. Motor Characteristics: Refer to Equipment Schedules for specific data.  
277/480 Volt System: Motors 1/2HP & Larger - 480V, 3 Phase, 3 Wire  
Motors Less than 1/2HP-120/277V, 1 Phase, 2 Wire.
- H. All motors rated less than 1/2HP shall have thermal protection of the auto-reset type as an integral part of the motor.
- I. All motors rated 1/2HP and larger shall have thermal protection provided by an external device.
- J. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer’s written instructions.

**PART 3 – EXECUTION**

**3.1 PIPING SYSTEMS**

- A. All piping to drain to low points. Low points shall be provided with drain valves with hose thread.
- B. All piping shall be arranged to have air vents at high points.
  - 1. Air vents shall be automatic in operation when located in Boiler Rooms, Chiller Rooms and Mechanical Equipment Rooms. All air vents shall be provided with a PVC drain line which shall be routed to the nearest floor drain. Several air vents may be tied together.

2. Air vents shall be manual in operation in all other locations.
3. Air vents on steam shall be piped down to floor with copper drain line.
- C. Do not install trapped lines where water cannot be drained or air can accumulate without being vented.
- D. Piping shall run square with building lines.
- E. Piping shall not be insulated or covered until tested.
- F. Necessary drains, off-sets, vents and drips shall be provided for coordination of the work as part of the contract.
- G. Running or close nipples are not permitted.
- H. Piping shall not be installed over electrical transformers, panels, switchgear, substations, and control panels. No piping shall be installed in elevator machine rooms.
- I. Exposed insulated piping risers in unfinished spaces shall be covered with 22 gauge galvanized steel sleeves from floor to ceiling. Refer to Section: Insulation & Covering – HVAC for additional requirements.
- J. Allow clearance for expansion and contraction.
- K. Install eccentric piping fittings where change in sizes occurs in piping systems. Tops of pipes shall remain level for hydronic systems. Bottom of pipe shall remain level for steam systems.
- L. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.
- M. Do not support piping from other piping, conduits or equipment.
- N. Strainers shall be installed on suction of all pumps, inlets of control valves, and where indicated on drawings.
- O. Thermometers and gauges shall be installed where indicated on the drawings, required by equipment specifications and where indicated elsewhere in the specifications.
- P. Flexible connectors shall be provided on suction and discharge piping of all base mounted pumps.
- Q. Unions shall be provided adjacent to all valves, at equipment connections, and where necessary to facilitate dismantling of the piping system.
- R. Install expansion joints, expansion compensators, anchors and guides in piping systems as shown on the drawings and in accordance with manufacturer's written instructions.
  1. Provide anchors and guides on both sides of the expansion compensator or expansion joint in accordance with EJMA Standards.
  2. Provide anchors and moment guides in each pipe, with the first moment guide located the equivalent of four-pipe diameters from the compensator, and the second guide fourteen pipe diameters beyond the first guide.
  3. Remove all shipping blocks, stays, setscrews, etc., from all compensators and moment guides. Pipe centerlines shall be aligned.
  4. During initial system pressurization, all pipe guides and anchors must be secure and functioning.
- S. Material Requirements for Systems:
  1. Heating Hot Water Supply & Return Piping:
    - a. Schedule 40 black steel.
    - b. Type L hard copper.
    - c. Grooved End black steel.
  2. Chilled Water Supply & Return Piping:

- a. Schedule 40 black steel.
- b. Type L hard copper.
- c. Grooved End black steel.
- 3. Make-up Water: Type L hard copper.
- 4. AC Condensate Drain (including pumped condensate):
  - a. Type DWV copper.
  - b. Schedule 40 PVC.
- 5. Refrigerant Piping: Type ACR hard copper.

3.2 TAGS, CHARTS AND IDENTIFICATION

- A. See Paragraph "Labeling" in GENERAL PROVISIONS for equipment labeling.
- B. Identify each valve in all systems with black, numbered and stamped 1- 1/2" brass or aluminum tags fastened to valve by brass chain and S-hook.
- C. Provide 1/8" scale diagrams showing location, number and service or function of each tagged item.
  - 1. Frame diagrams in approved metal frames with clear acrylic front, hinges, and locks.
  - 2. Provide two additional separate copies permanently covered and bound.
    - a. Include one (1) copy in the Operation and Maintenance Manuals.
- D. Piping Identification: Identify piping with Seton "Setmark" or Brimar, semi-rigid plastic, wraparound pipe markers with flow arrows and conforming to ANSI A13.1. Locate marker at each valve, changes in direction, where pipes pass thru barriers and every 25' of horizontal runs. Lettering on background shall be in accordance with the following colors:

Legend		Background	Lettering
1.	Chilled Water Supply	- Green	- White
2.	Chilled Water Return	- Green	- White
3.	Heating Water Supply	- Yellow	- Black
4.	Heating Water Return	- Yellow	- Black
5.	Refrigerant Liquid	- Yellow	- Black
6.	Refrigerant Gas	- Yellow	- Black

- E. Provide color coded 1" diameter markers on ceiling tile grids to indicate system and valve locations.
  - Chilled Water: - Blue
  - Hot Water: - Red
- F. Manufacturers: Seton "Setmark", Brimar, B-Line MSI.

3.3 WELDING

- A. All concealed and inaccessible black steel piping shall be welded.
- B. All black steel piping larger than 1-1/4 inch may be fusion welded.
- C. All elbows, tees and branch connections shall be made with welding fittings ANSI B16.9.
- D. Welding shall be in accordance with the ASME Boiler and Pressure Vessel Code Section IX.
- E. Furnish welder test certificate for review. Certificates of successful qualification by the following organizations shall be acceptable.

1. ASME Boiler and Pressure Vessel Code
2. ANSI Code for Pressure Piping
3. National Certified Pipe Welding Bureau
4. Military Specification MIL-STD-248

3.4 SOLDERING/BRAZING

- A. Connections between copper tubing and copper fittings shall be made with the appropriate filler metal. Flux shall be non-corrosive type as recommended by the manufacturer of the filler metal, and conforming to AWS A5.8.
- B. Tubing shall be cut square and then reamed and deburred. End of tubing and inside of fitting cup shall be cleaned with steel wool and the flux shall be applied to the clean surface before joining. After joining, the excess filler metal shall be wiped off while still plastic.
- C. Silver brazing alloy shall be equal to Easy-Flo by Handy and Harmon or Sta-Brite silver solder and shall be used for joints in:
  1. Hot water heating piping
  2. Chilled water piping
  3. Air conditioning condensate drain piping
  4. Dual temperature water piping
  5. Cold water fill and make-up piping
  6. Condenser water piping
- D. Where the silver brazing is performed in a confined non-ventilated space, a non-toxic, cadmium-free brazing alloy such as braze 560 by Handy & Harman shall be used.
- E. Refrigerant piping shall be silver brazed using Harris Sil-Fos 15 or equivalent, with nitrogen purge.
- F. Bring joint to solder temperature or brazing temperature in as short a time as possible.
- G. Form continuous solder bead or brazing filler bead around entire circumference of joint.
- H. Wipe excess solder from joint area while solder is still plastic.

END OF SECTION 23 0210



**SECTION 23 0215**  
**VALVES**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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.
- B. Refer to Section 230200 for HVAC General Provisions.
- C. Refer to other sections in Division 23 for materials and methods not specified herein.

1.2 DESCRIPTION OF WORK

- A. This Section includes the following:
  - 1. General
  - 2. Hot Water Heating System
  - 3. Refrigerant Valves and Specialties
  - 4. Grooved End Specialties

1.3 QUALITY ASSURANCE

- A. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.
- B. Verify that all work and equipment is installed in accordance with manufacturer's warranty requirements.

**PART 2 – PRODUCTS**

2.1 GENERAL

- A. All gate and globe valves shall be designed for repacking under pressure when fully opened, and shall be equipped with packing suitable for the intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. All gate and globe valves shall have a gland follower. The pressure- temperature rating of valves shall be not less than the design criteria applicable to all components of the system.
- B. Insofar as possible, all valves of the same type shall be of the same manufacture.
- C. Valves installed above 7 ft. in Mechanical Rooms shall have chain operators.
- D. All valves shall be provided with stem extensions. Valve handle shall be clear of insulation jacket.
- E. Manufacturers:
  - Stockham
  - Milwaukee
  - Hammond
  - Apollo
  - Watts
  - Walworth
  - Nibco
  - Jamesbury

## 2.2 HOT WATER HEATING SYSTEM

### A. Gate Valves - 2" and smaller:

Valves 2" and smaller shall be of Class 150 with body and union bonnet of ASTM B-62 cast bronze composition, threaded or solder ends, solid disc, copper-silicon stem, brass packing gland, Teflon-impregnated packing, and malleable handwheel.

Recommended valves:

Threaded:	Solder:
Stockham B-120 (RS)	Stockham B-124
Stockham B-130 (RS)	----
Hammond IB629	IB648
Nibco T134	S134

### B. Ball Valves - 3" and smaller:

Valves 3" and smaller shall be 600 psi CWP, have cast brass bodies, replaceable reinforced Teflon seats, conventional port, blowout proof stems, chrome plated brass ball, and threaded or solder ends with extended solder cups. Provide extended valve handle to accommodate up to 2" of insulation with non-thermal conductive material, insulation plug, cap and protective sleeve.

Recommended valves:

Threaded:	Solder:
Stockham S-216-BR-RT	Stockham S-216-BR-RS
Worcester 4112 RT	---
Jamesbury II 1100TT	----
Apollo 70-100	Apollo 70-200
Nibco T580-70EL	S580-70EL
Inline 334	----

Drain valves, 1/2" or 3/4", shall be 600 psi CWP, with stainless steel trim, cast bronze body, 2-piece with cap and chain, full port stainless steel ball and stem, RTFE ball seat, threaded or soldered inlet connection, cap rated for 150 psi.

Recommended valve:

Stockham S-285-BR-R-66-HC

### C. Gate Valves - 2-1/2" and larger:

Valves 2-1/2" and larger shall be Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, with Teflon-impregnated packing and two-piece packing gland assembly.

Recommended valves:

Stockham G-623 (OS&Y) RS		
Stockham G-612 (NRS)		
	OS&Y	NRS
Nibco	F618-0	F639-31
Hammond IR1140		

### D. Globe Valves - 2" and smaller:

Valves 2" and smaller shall be of Class 150 with body and union bonnet of ASTM B-62 bronze, copper-silicon alloy stem, brass packing gland, Teflon-impregnated packing and malleable handwheel.

Recommended valves:

Threaded:	Solder:
Stockham B-22 (Teflon Disc)	Stockham B-24 (Teflon Disc)
Stockham B-29 (Stainless trim) ----	
Comp. Disc.:	S.S. Trim:
Nibco T-235-Y	Milwaukee 591A

E. Globe Valves - 2-1/2" and Larger:

Valves 2-1/2" and larger shall be Class 125 body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, with Teflon - impregnated packing and two-piece packing gland assembly.

Recommended valves:

Stockham G-512 (bronze disc)  
Stockham G-514 (Teflon disc)  
Hammond IR 116  
Nibco F7181B

F. Butterfly Valves - 2-1/2" and Larger:

Valves 2-1/2" and larger shall be high performance, bubble-tight, wafer type body or grooved-end, 200 psi CWP, conforming to ASTM A-126 Class B cast iron, replaceable EPDM sleeve, with ductile nickel-plated disc, 410 stainless steel stem, and EPDM O-ring stem seals. Sizes 2 - 6" shall have lever operators and 8 - 24" shall have gear operators.

Recommended valves:

Stockham LG-512-DS3-B	Lever operated
Stockham LG-522-DS3-B	Gear operated
Victaulic 300 Masterseal and AGS VIC300 – Grooved end	
Lever:	Gear:
Demco NE 150-1215351	NE-150-121359-2097
Norris R1010-13SS-1F	R1010-13SS-2K
Keystone Fig. 239	239
Center Line Series A	Series A
Nibco WD 3110-3	WD 3110-5

Note: In Treated Systems, valves with aluminum bronze disc (ASTM B-148 Alloy 954) and EPT or EPDM sleeve may be preferred.

Recommended valves:

Stockham LG-512-BS3-E	Lever operated
Stockham LG-522-BS3-E	Gear operated
Victaulic 300 Masterseal and AGS VIC300 – Grooved end	

TREATED SYSTEM:

Recommended Valves:

Stockham LG-712-BS3-E      Lever operated

Stockham LG-722-BS3-E      Gear operated

Victaulic 300 Masterseal and AGS VIC300 – Grooved end

G. Check Valves - 2" and smaller:

Valves 2" and smaller shall be Class 150 with bodies and caps of ASTM B-62 bronze composition and threaded ends. Class 150 valves shall have lift-type Buna-N-disc and union caps, and are to be used in lines with globe valves.

Recommended valves:

Stockham B-322-B

Hammond IB948

Milwaukee 510

For backflow prevention in lines with gate valves, Y-pattern valves with swing-type disc are recommended.

For Class 150 Service, threaded ends:

Stockham B-321

H. Check Valves - 2-1/2" and Larger:

Valves 2" and larger shall be iron body, bronze mounted, with body and cap conforming to ASTM A-126 Class B cast iron, flanged or grooved ends, and swing-type disc.

Recommended valves:

Stockham G-931

Hammond IR1124

Nibco F918-B

Victaulic 716, 779, or W715 – Grooved end

**OR**

Alternative for the above listed check valves shall be Class 125/250 iron body, bronze mounted, Wafer Check Valve, with ends designed for flanged type connection, aluminum bronze disc, EPDM seats, 316 stainless steel torsion spring, and hinge pin.

Recommended valves:

Stockham WG-971

Mission K12 HMP

Center Line CLC Series

Marlin A125 HZDSF

2.3 REFRIGERANT VALVES & SPECIALTIES

A. Service Valves:

1. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300 degrees F (149 degrees C) temperature rating, 500 psi working pressure.
2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250 degrees F (121 degrees C) temperature rating, 500 psi

- working pressure.
3. Manufacturers:  
Henry Valve Co.  
Parker Hannifin Corp., Refrigeration & Air-Conditioning  
Sporlan Valve Co.
- B. Solenoid Valves:
1. 2-way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24-volt, 60 Hz., UL-listed, 1/2" conduit adapter, 250 degrees F (121 degrees C) temperature rating, 400 psi working pressure.
  2. Manufacturers:  
Alco Controls Div., Emerson Electric Co.  
Automatic Switch Co.  
Sporland Valve Co.
- C. Specialties:
1. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL listed, 350 psi working pressure.
  2. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL listed, 200 degrees F (93 degrees C) temperature rating, 500 psi working pressure.
  3. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
  4. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.
  5. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL listed.
  6. Manufacturers:  
Alco Controls Div., Emerson Electric Co.  
Henry Valve Co.  
Parker-Hannifin corp., Refrigeration & Air Conditioning Div.  
Sporlan Valve Co.

### **PART 3 – EXECUTION**

#### **3.1 PIPING SYSTEMS**

- A. All piping to drain to low points. Low points shall be provided with drain valves with hose thread.
- B. Valve body construction shall match piping system material.
- C. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.
- D. Valves shall be installed with stems above horizontal.
- E. Valves shall be installed on all sides of equipment and control valves to allow isolation for repair.
- F. Unions shall be provided adjacent to all valves, at equipment connections, and where necessary to facilitate dismantling of the piping system.

3.2 TAGS, CHARTS AND IDENTIFICATION

- A. Identify each valve in all systems in accordance with requirements of Section 230210.

END OF SECTION 23 0215

**SECTION 23 0230**  
**INSULATION & COVERING – HVAC**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

- A. 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.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.

**1.2 DESCRIPTION OF WORK**

- A. This Section includes insulation and covering provided on the following piping and equipment:
  - 1. Hot Water Heating Piping
  - 2. Chilled Water Piping
  - 3. Condensate Drain Lines
  - 4. Refrigerant Piping.
  - 5. Acoustic Duct Liner
  - 6. Reusable Valve Covers
  - 7. Insulated Pipe Saddles
- B. Insulation shall be installed on the following duct systems:
  - 1. All supply ductwork.
  - 2. All return ductwork.
  - 3. All outside air intake and relief ductwork.
  - 4. All ductwork connected to energy recovery units.

**1.3 REFERENCE STANDARDS**

- A. Refer to Section 230200 for a general description of requirements applying to this section.

**1.4 QUALITY ASSURANCE**

- A. Refer to Section 230210 for a general description of requirements applying to this section.
- B. Install insulation in accordance with manufacturer's recommendations.
- C. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.

**1.5 SUBMITTALS**

- A. Submit shop drawings, installation instructions, and manufacturer's literature of all materials specified in accordance with Section 230200.
- B. Submit fabrication instructions for pipe fitting and valve insulation.
- C. Submit manufacturer's joining recommendations for butt joints and longitudinal seams.

**1.6 WARRANTY/GUARANTEE**

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

## **PART 2 – PRODUCTS**

### **2.1 PIPE INSULATION MATERIAL**

#### **A. Fiberglass:**

1. Material: Preformed fiberglass bonded with resin to form circular pipe sleeves with factory applied, white all service jacket bonded to reinforced foil vapor barrier jacketing. The jacket shall have factory applied double pressure-sensitive, self-sealing, adhesive closure and vapor sealing of longitudinal joints. Thermal conductivity: 0.24 Btu/Hr./SF/inch at 100 degrees F. Flame spread of 25 and developed smoke of 50 or less.
2. All Valves and Fittings:
  - a. Glass fiber insert and pre-molded PVC cover, Proto Corp., Johns Manville Corp. "Zeston" and "Hi-Lo Temp Inserts" for fittings. Glass fiber or prefabricated elastomeric foam fittings must fill the entire space within the cover completely.
  - b. Factory molded fibrous glass fitting covering for fittings. Coat ends with Fosters 30-36 lagfast adhesive
  - c. Mitered sections of pipe covering for valves.
3. Manufacturers: Johns Manville Corp., Certain-Teed, Owens- Corning, Knauf, Armacell.

#### **B. Closed Cell:**

1. Material: Black flexible elastomeric foamed closed cell structure insulation 25/50 rated with a flame spread rating of 25 or less and a smoke developed rating of 50 or less with both a moisture seal and a reinforced elastic foam lap seal closure system.
2. Flexible pipe insulation shall be a foamed elastomeric closed cell structure material, with a thermal conductivity of not more than 0.27 Btu/Hr./Sq. Ft./Inch at a mean temperature of 75 degrees F. The insulation shall have an average density of at least 2 pounds per cubic foot, shall be self-extinguishing, and shall have a water vapor transmission rating of not more than 0.1 perms. Between temperature limits of -40 degrees F and plus 220 degrees F, the insulation shall not indicate any deviation from its original state.
3. Specification Compliance:
  - ASTM-E-84
  - ASTM-C-534 Type I – Tubular, Type II – Sheet.
  - ASTM-D-1056, 2B1 – Tubular, Sheet.
  - MIL-C-3133B (MIL STD 670B) Grade SBE-3
  - MIL-P-15S280J, Form T, Form S.
4. Manufacturers: Armacell, Nomaco, K-Flex, Aeroflex USA, Inc.

#### **C. Covering of Pipe Insulation Outdoors:**

1. Wrapping: Wrap insulation with embossed 0.016" aluminum jacket.
2. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.
3. Valves and Fittings: Weatherproof all valves and fittings.

#### **D. Manufacturers: Johns Manville Corp., Certain-Teed, Owens- Corning, Knauf.**

### **2.2 DUCT INSULATION**

- #### **A. Concealed Supply, Return, Relief, and Outside Air Ductwork, and all ductwork connected to energy recovery units: Fiberglass duct wrap bonded with resins, 3/4 pound density, aluminum foil facing reinforced with fiberglass scrim, laminated to Kraft, 2" thick.**

1. Thermal Conductivity: 0.27 Btu/Hr./SF/Inch at 75 degrees F. Min. installed "R" value shall be 6.0 and have a min. 25% compression of 5.6.
  2. Duct wrap shall be cut to stretch-out dimensions as provided in manufacturer's instructions. Remove a 2" piece of insulation from the facing at the end of the piece of insulation to form an overlapping staple and tape flap. Install with facing outside so tape flap overlaps insulation and facing at other end. Insulation shall be tightly butted and not compressed excessively at duct corners. Seams shall be stapled 6" on center with outward clinching staples. All seams, tears, punctures and other penetrations of the insulation facing shall be sealed with foil tape or vapor proof mastic. Where rectangular ducts are 24" in width or greater, duct wrap shall be secured to the bottom of the duct with mechanical fasteners; i.e., stick pins spaced 18" on center.
- B. Exposed supply, return, relief, and outside air ductwork, and all ductwork connected to energy recovery units, shall be insulated in finished conditioned spaces, penthouse, mechanical rooms, mezzanine areas, equipment closets, and non-conditioned spaces with 2" thick rigid fiberglass board. Insulation shall be 6 P.C.F. density with a "K" value of 0.25 Btu/Hr./SF/Inch at 75 degrees F. mean temperature and shall be U.L. listed at 25 maximum for flame spread, and 50 maximum for smoke developed. Insulation shall be applied using Graham Pins or Stik-Clips and all seams, edges and breaks shall be sealed with 4" matching tape and sealed with Vicryl CP-10 to match ASJ jacket. Insulation shall be provided with all-service jacket facing.
- C. Manufacturers: Johns Manville Corp., Certain-Teed or Owens- Corning, Knauf.
- D. Outdoor Installation:
1. Pre-manufactured panel system consisting of four (4) piece interlocking panels.
  2. The interlocking panels shall be constructed of Dow Thermax Polyisocyanurate insulation, ASTM D-1622, nominal 2 pcf; water vapor transmission as permeance less than 0.03, per ASTM E-96; water absorption less than 0.3% (24 hours), per ASTM C-209; flexure strength more than 40 psi, per ASTM C-203.
  3. Operating temperature range of -100°F to +250°F.
  4. Insulation shall be laminated in two (2) layers to provide R-14 at 2" thickness, per ASTM C-236/C-518.
  5. The insulation shall be jacketed with 0.032" thick embossed aluminum and sealed with vapor barrier compound. All joints shall interlock to ensure a thermal seal.
  6. Panels shall be secured with #10 self-tapping stainless screws with weather seal washers.
  7. Manufacturers: Techna-Duc Insulation System as made by P.T.M. Manufacturing, L.L.C., Newark, Delaware.

### 2.3 ACOUSTIC DUCT LINER

- A. Duct liner shall be designed for use as an acoustical insulation to absorb air conditioning noise in sheet metal ducts and plenums operating at velocities up to 6000 fpm and temperatures up to 250 deg. F.
- B. Duct liner shall be a bonded mat of glass fibers coated with an EPA registered biocide and a black pigmented fire-resistant coating on the air stream side or flexible elastomeric closed cell foam made with an EPA approved anti-microbial.
- C. Duct liner shall comply with the requirements of NFPA 90A and 90B. Surface burning characteristics shall comply with UL Standard 723 for 25/50 flame and smoke development.
- D. Duct liner shall comply with the property requirements of ASTM Specification C1071 Type 1, or ASTM C1534. Material shall resist fungal and bacterial growth when subjected to ASTM G21 and G22 test methods.

- E. Material thickness, name of manufacturer and type shall be printed on the air stream side of the liner for ease of identification.
- F. Duct liner shall be 2" thick, unless otherwise noted on the drawings.
- G. Manufacturers: Owens Corning QuietR® AcousticR™ Duct Liner, Certaineed, Evonik Industries Solcoustic, Johns Manville Linacoustic® RC, Armacell.

#### 2.4 REUSABLE VALVE COVERS

- A. All valves, strainers, combination valves, etc. in chilled water and heating hot water systems shall be insulated with a factory fabricated removable and reusable cover. (This product shall not be used for pipe and fittings.)
- B. Insulation shall be either fiberglass blanket or flexible elastomeric thermal insulation as listed in Paragraph 3.2 of this specification, or prefabricated fitting from the supplier. Flame and smoke spread shall be 25/50 per ASTM 84.
- C. Outer jacket shall be made of material equal to Tychem QC, overlap and completely cover the insulation, with seams joined by tabs made from Velcro or fabric straps per manufacturer's standards.
- D. Outer jacket shall overlap adjoining sections of pipe insulation, and shall be non-combustible, impermeable to water, and prevent mold, mildew and condensation.
- E. Installation shall not require the use of any special hand tools.
- F. Manufacturers: Corick Valve Covers, NoSweat Valve Wraps.

#### 2.5 INSULATED PIPE SADDLES

- A. Insulation and facing shall each meet 25/50 flame and smoke ratings per ASTM E-84 on a component basis.
- B. A section of rigid insulation shall be used at all cold pipe hangers or support locations and shall consist of:
  - 1. A rigid 3.75 PCF phenolic foam pipe insulation designed to support pipe sizes up to and including 6" iron pipe size.
  - 2. A rigid 5 PCF phenolic foam pipe insulation designed to support pipe sizes from 8" to 30" iron pipe size.
  - 3. For all hot pipe hanger or support locations, the insert material shall be either rigid calcium silicate per ASTM C303 or perlite silicate per ASTM C303 with all service jacket and laminated to a steel support saddle.
- C. The insulation jacket shall contain a vapor retarding material to provide low moisture vapor permeability and resistance to mold, mildew and fungus growth.
- D. The insulation shall be free of any CFC or HCFC materials.
- E. The insulation shall have a minimum K-factor of 0.13 at 75 deg. F mean temperature, and self-sealing lap joint with high performance acrylic pressure sensitive adhesive tape.
- F. Integral insulation saddle shall be made of G-90 carbon steel, with full 180 deg. Coverage, flared edges to protect the vapor barrier jacket and insulation, and short rib surface to center the saddle inside the hanger and prevent movement.
- G. Preformed insulation shall extend beyond the saddle by a minimum of 1-1/2" to accommodate a tape joint seal at the butt edges of adjoining insulation sections.
- H. Minimum product dimensions shall be as follows:

Nominal pipe size (inches)	Insulation density (PCF)	Insulation length (inches)	Saddle length (inches)	Saddle gauge
½ - 3-1/2	3.75	9	6	20
4 – 6	3.75	12	9	18

- I. Manufacturer: Tru-Balance insulated saddles as made by Buckaroos, Inc., Aerofix-U as made by Aeroflex USA, Inc.

**PART 3 – EXECUTION**

**3.1 INSTALLATION – GENERAL**

- A. Do not install until systems have been tested and meet requirements.
- B. Heavy work which may damage insulation shall have been completed in the vicinity of the insulation work.
- C. Provide non-compressible insulation saddles at all piping hanger locations, and at all piping hanger locations where piping is insulated with flexible closed cell insulation.  
 Option: Provide insulation coupling system as made by Klo-Shure Co.
- D. All installations shall be made by skilled craftsmen regularly engaged in this type of work.
- E. Insulation shall be continuous thru-wall, ceiling and floors.
- F. Metal shields, 16 gauge galvanized, shall be installed between hangers and pipe insulation.
- G. Pipe, ductwork and equipment shall be clean and dry prior to insulating.
- H. Install all insulation per manufacturer's instructions.
- I. To avoid undue compression of insulation, provide solid core inserts at all supports as recommended by the insulation manufacturer. Provide insulation shields between the insulation jacket and the hanger.
- J. Ductwork treated with internal acoustic duct liner does not require external insulation.

**3.2 PIPE INSULATION – TYPES & THICKNESSES**

- A. Provide fiberglass insulation of thickness specified on:
  1. Heating Hot Water: (141°F to 200°F)
    - 1-1/2" for piping less than 1-1/2"
    - 2" for pipes 1-1/2" and over.
  2. Chilled Water:
    - 1/2" for piping less than 1-1/2". Option: Flexible closed cell insulation
    - 1" for piping 1-1/2" and over
  3. Refrigerant Piping: Interior locations, exposed and concealed for suction lines and hot gas bypass lines, if applicable. (NOTE: Insulate liquid line if metering device is mounted at the condensing unit.) Option: Flexible closed cell insulation
    - Suction Line:
      - 1/2" for piping less than 1-1/2"
      - 1" for piping 1-1/2" and larger
    - Hot Gas Bypass: (Liquid Line)
      - 1" for piping less than 1-1/2"

1-1/2" for piping 1-1/2" and larger

B. Provide flexible closed cell insulation of thickness specified on:

1. Refrigerant Piping: Exterior Locations for suction lines and hot gas bypass lines, if applicable. (NOTE: Insulate liquid line if metering device is mounted at the condensing unit.)

Suction Line:

1/2" for piping less than 1-1/2"

1" for piping 1-1/2" and larger

Liquid Line:

1" for piping less than 1-1/2"

1-1/2" for piping 1-1/2" and larger

Hot Gas Bypass:

1" for piping less than 1-1/2"

1-1/2" for piping 1-1/2" and larger

2. Cold surfaces of refrigeration equipment, air separators for chilled and heating hot water, and chilled water pumps. 3/4" thickness
3. 1" thickness for all water piping within terminal unit cabinets.
4. 1/2" thickness for condensate drain lines.

3.3 PIPE COVERING (FOAMED PLASTIC TYPE)

- A. All joints and seams shall be sealed with a compatible adhesive. Approved adhesives are as follows:

Armstrong World Industries No. 520

Benjamin Foster Company No. 85-75 up to 200 degrees F.

Contractor may use Armstrong Self-Seal Armaflex 2000 insulation in lieu of the above wherever 1/2" is specified.

- B. Fitting covers shall be fabricated from the foamed plastic pipe insulation or from sheet insulation of the identical material. The fabrication shall be in accordance with manufacturer's instructions, and all seams mitered joints shall be joined using the adhesives described hereinbefore.

- C. Pipe insulation in concealed spaces shall require no finish coatings.

- D. Pipe insulation in all other areas shall receive two coats of finish of color selected by Architect. Approved finishes are as follows:

Armstrong World Industries WB Armaflex Finish

3.4 EXTERIOR PIPE COVERING

- A. Wrapping: Wrap insulation with embossed 0.016" aluminum jacket, orient seam down.

- B. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.

- C. Valves and Fittings:

1. Weatherproof all valves and fittings.

2. Finish: Apply two coats of vapor resistant mastic reinforced with glass fabric over wrapping.

3.5 INTERIOR PIPE COVERING

- A. Provide premolded PVC cover on all interior insulated piping exposed in finished spaces. Orient seams up in overhead piping and toward the wall in vertical runs.

- B. Provide factory molded fitting covering for fittings and accessories, sealed and held in place by manufacturer's recommended sealing system.
- C. Provide mitered sections of covering for valves.

### 3.6 ACOUSTIC DUCT LINER

- A. All portions of duct designated on the drawings to receive duct liner shall be completely covered with duct liner, adhered to the sheet metal with a 100% coverage of adhesive complying with ASTM C916.
- B. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. All transverse joints and all exposed leading edges shall be coated. The black coated surface of the duct liner shall face the airstream.
- C. Duct liner shall be secured with mechanical fasteners which shall compress the duct liner sufficiently to hold it firmly in place.
- D. Duct liner shall be cut to assure overlapped and compressed longitudinal joints.
- E. After installation is complete, blow out the duct system prior to operation to remove any cutting scraps and foreign material remaining in the duct.

### 3.7 INSULATED PIPE SADDLES

- A. Insulated pipe saddles shall be installed at all hangers, rollers or supports in accordance with manufacturer's written instructions.
- B. All piping shall be clean and free of oil, rust and moisture prior to and during support installation.
- C. All insulated saddles and accessories shall be stored in a dry area protected from weather before and during installation
- D. Seal adjoining butt edges of pipe insulation with approved mastic and tape to insure continuity of the insulation jacket and vapor barrier, especially on cold piping system installations.

END OF SECTION 23 0230



## SECTION 23 0300

### VIBRATION AND SOUND ISOLATION – HVAC

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. 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.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.

##### 1.2 DESCRIPTION OF WORK

- A. This Section includes providing the following vibration and sound isolation material on items furnished and installed under HVAC work:
  - 1. Fans and AHU's
  - 2. Suspended Fans, H&V Units

##### 1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.

##### 1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this section.

##### 1.5 SUBMITTALS

- A. Submit shop drawings, installation instructions, and manufacturer's literature of all materials specified in accordance with Section 230200.
- B. Submit the following:
  - 1. Shop drawings
  - 2. Product data

##### 1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

#### PART 2 – PRODUCTS

##### 2.1 GENERAL

- A. All vibration control apparatus shall be furnished by a single recognized manufacturer. The manufacturer shall submit to the Architect/Engineer evidence affirming that he has been a supplier of vibration control devices of the type required for the past five years.
- B. The vibration control apparatus manufacturer shall supervise, inspect, measure, and approve the installation and shall submit a report to the Architect/Engineer substantiating that all the equipment has been adequately isolated.
- C. Any requests for changes in the specifications must be submitted in writing in time for review and approval through a written addendum to the specifications prior to bid closing.
- D. Unless otherwise indicated or specified, all equipment mounted on vibration isolator bases shall have a minimum operating clearance of 1 inch between the base and the floor or housekeeping and beneath. Clearance space shall be checked to ensure that no scrap, rubbish, hardware, etc., has been left to possibly short circuit isolated base.

- E. In connecting isolated HVAC equipment to rest of system, care must be exercised to insure proper installation.
  - 1. Equipment connected to water piping shall be erected on isolators or isolated foundations to correct operating height prior to making piping connections to avoid misalignment problems. To facilitate this, equipment shall be blocked-up with temporary shims to final operating height. When full load is assembled and water is in system, isolators shall then be adjusted to take up load just enough to allow removal of shims.
  - 2. Air handling equipment such as centrifugal fans shall be erected on isolators and leveled with fan operating before flexible duct connection is made. Insure that duct position is in proper alignment and providing proper clearance in proportion to flexible duct connector length. When fan is shut off, misalignment with ductwork is allowable providing it does not strain or damage flexible duct connector. In cases of high static pressure, fans requiring position stabilizers are to be adjusted when fan is operating to achieve the results as described above with isolator adjustment.
- F. Vibration isolator sizes and location shall be determined by the vibration control products manufacturer or as specified herein.
- G. Model numbers of Amber/Booth Co., are given for identification. Products of specified manufacturers will be acceptable, provided they comply with all of the requirements of this specification.

## 2.2 ISOLATOR TYPES

- A. Fans and Air Handling Units:
  - 1. For floors above-grade, up to 40 ft. span, provide:
    - a. Type SW = Spring Isolators: Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
    - b. Type PBSRA - Combination Neoprene and Spring: Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
    - c. Thrust Restraints: Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow 1/4" maximum movement when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.
- B. Suspended Fans and H&V Units
  - 1. For floors above-grade, up to 40 ft. span, provide:
    - a. Type SW = Spring Isolators: Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
- C. Manufacturers: Amber/Booth, Kinetics Noise Control, Mason Industries, Vibration Mounting & Controls, Vibration Eliminator, Inc., Vibro-Acoustics.

## **PART 3 – EXECUTION**

### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's specifications and instructions.
1. No metal-to-metal contact will be permitted between fixed and floating parts.
  2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.
  3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling and bolting.
  4. Provide heat shields where elastomers are subject to high temperatures.
  5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
  6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.
  7. Ensure that the outer surface of the equipment or duct is clean and free of dust, dirt or similar foreign matter. If desired, the outside surface can be painted with a rust-resistant paint in order to minimize potential corrosion.
    - a. Field cut and apply the insulation decoupler to the outside of the duct. Obtain a uniform thickness by butting all seams together (do not overlap). At elbows or similar transitions, field measure and miter cut the insulation to fit. Ensure that the insulation is not compressed by the fastener used, if any.
    - b. Wrap the noise barrier around the equipment housing or insulation-wrapped duct. At all seams, overlap the barrier by a minimum of 2" and adhere using adhesive. Alternately, the barrier can be butted together at joints with the seam covered by a 2" (50 mm) wide cut piece of the barrier material. This strip is then adhered to the barrier on either side of the seam using adhesive.
    - c. If desired, metal or nylon bands can be wrapped around the outside of the barrier to guard against the potential of adhesive failure. If used, this banding should be placed on either side of all radial seams in addition to the midpoint on longer sections. Ensure that the banding is snug only and does not result in compression of the insulation decoupler beneath.
    - d. In lieu of banding, insulation "stick pins" can be used to reinforce the seams in the noise barrier. Ensure that the pin does not compress the insulation or barrier material beneath.
- B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair or replace isolators as required to reduce vibration and noise transmissions to specified levels.

END OF SECTION 23 0300



## SECTION 23 0600

### AIR DISTRIBUTION & ACCESSORIES – HVAC

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. 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.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.
- D. This Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical. Mount smoke detectors in the supply and return air stream at each unit in accordance with NFPA 72.

##### 1.2 DESCRIPTION OF WORK

- A. This Section includes labor, material, equipment and supervision to provide a complete air distribution system as specified herein and as shown on drawings.
  - 1. Ductwork – Single Wall, Square and Rectangular
  - 2. Flexible Connections
  - 3. Dampers
  - 4. Air Diffusers, Registers and Grilles
  - 5. Fabric Air Dispersion System
  - 6. Roof-Mounted Relief Hoods
  - 7. Prefabricated Roof Curbs and Equipment Supports
  - 8. Roof-Mounted Intake/Exhaust Ventilators
  - 9. Sound Attenuators

##### 1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. Requirements established within the portions of the Project Manual titled Division 1, General Requirements, are collectively applicable to the work of this section.
- C. IMC (International Mechanical Code).
- D. SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.)
- E. American Society of Heating, Refrigerating and Air Conditioning Engineers' recommendations in ASHRAE Guide shall apply to this work.
- F. ARI Standard 885 - Standard for Estimating Occupied Sound Levels in the Applications of Air Terminals and Air Outlets.
- G. UL (Underwriter's Laboratories, Inc.)
- H. NFPA 90A shall apply to this work.
- I. State Fire Prevention Regulations.

#### 1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this Section.

#### 1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 230200.
- B. Submit the following:
  - 1. Shop drawings of all sheet metal. Indicate all steel, piping, conduit, and Architectural/Structural features to demonstrate complete coordination. Scale shall not be less than 1/4".
    - a. Shop drawings shall indicate the sizes and lengths of each section of ductwork as well as all system components such as coils, VAV boxes, access doors, dampers, diffusers and register locations. Also indicate the type of joints used and where internal acoustic lining or insulation, if required, will be utilized.
    - b. The location of the duct runs and the air outlets shall be closely coordinated with all other trades by the sheet metal contractor to avoid interference. The shop drawings shall show the contact surfaces adjacent to the ducts or air outlets and the space assigned for concealment. The drawings shall indicate principal items of equipment, adjacent piping and conduit, etc., the location of which shall be secured from the contractors of other trades.
    - c. Sheet Metal Contractor to include resubmissions of the shop drawings to the Engineer. The resubmissions are to include all corrections to previous submissions.
  - 2. Manufacturer's literature and performance data of all equipment and devices.
  - 3. Samples: Furnish color samples, etc., at request of the Architect.

#### 1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, they shall be responsible for any and all additional costs associated with the changes required by other trades.

#### 1.7 WARRANTY GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

### **PART 2 – PRODUCTS**

#### 2.1 DUCTWORK (SINGLE WALL, SQUARE AND RECTANGULAR)

- A. All ductwork shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible" latest Edition except as described below. The minimum thickness of metal ductwork is 26 gauge. Fabrication requirements shall be based on ductwork subjected to positive or negative pressures of 3" W.G. Ductwork systems shall be sealed to SMACNA "Seal Class "B" Standards. Alternatively, "Ductmate" System 45 can be used in accordance with manufacturer's specifications. Drive slip joints are not permitted.

Exception: For ductwork smaller than 12" x 8", Contractor may provide slip and drive joints with all joints sealed with Hardcast tape and mastic system.

- B. Rectangular ducts for 3" W.G. or less, positive or negative pressure shall be per SMACNA Table 1-6. Longitudinal seams shall be Pittsburgh Lock Type L-1 per SMACNA Figure 1-5. Transverse

joints shall be standing seam type T -15 per Figure 1-4.

1. In the event that material size is not compatible with duct size and segmenting must be utilized to fabricate duct, use SMACNA Figure 1-5, seam L-4 (Standing Seam).

C. Joints:

1. Per SMACNA Transverse Joint Reinforcement Table 1-12, only joints T -22, T -25a, T -25b and Proprietary slip on flanges will be acceptable.
2. Joints T -25a and T -25b that have stress fractures from bending will not be accepted.
3. All joints will have butyl gasket 3/16" thick by 5/8" wide installed per manufacturers installation instructions.

D. Ductwork systems for this standard shall be galvanized sheet steel, commercial quality of lock - forming grade, conforming to ASTM coating standards A-525 or A-527 with coating of designation G-60. For corrosive or moist conditions, use coating designation G-90.

1. Where the outer surface of the duct is exposed in finished spaces and is not scheduled for insulation, duct material shall be galvanized, suitable for field painting by the General Contractor.

E. The size and configuration of each duct shall be indicated on design drawings. Where thicker sheets or different types of materials are required, they shall be specified on the design drawings or in the project specifications.

F. Aluminum Rectangular Ductwork:

1. Aluminum ductwork shall be two B.& S. gauges heavier than specified for the equivalent width steel ductwork. Bracing, supports and joints shall be as specified for steel ductwork.
2. Aluminum ducts shall be used where the ducts are concealed when exhausting saturated air from dishwashing, showers, outside air intakes and similar designated spaces.

## 2.2 FLEXIBLE CONNECTIONS

- A. Required between ductwork and suction and discharge connection of all fans and air handlers.
- B. Material: Woven fiberglass with mounting hardware tested in accordance with UL Standard 181, listed and labeled as Class 0 or 1.
- C. Manufacturer: Ventfabrics, Inc., Durodyne, Dynair, Ductmate Pro Flex.

## 2.3 DAMPERS

- A. Provide where indicated and required to control flow of air and balance system.
- B. Round dampers shall be single blade, molded synthetic bearings at each end, 20 gauge galvanized steel, adjusting quadrant and locking device. Round dampers shall be Ruskin Model MDRS25.
- C. Rectangular and square dampers shall be opposed blade within 16 gauge galvanized steel channel frame with corner brace, 16 gauge galvanized steel blades; molded synthetic bearings and hex steel shafts, exposed or concealed linkage, adjustable quadrant and locking device. Damper 10" and below shall be single-blade. Dampers shall be Ruskin Model MD35.
- D. Approved Manufacturers: Ruskin, Arrow, Nailor-Hart, Pottorff, Lloyd Industries, Inc., Cesco Products, Louvers & Dampers, United Enertech.

## 2.4 AIR DIFFUSERS, REGISTERS AND GRILLES

- A. Air diffusing terminals shall be provided in duct runs on drawings. The diffusers shall properly and uniformly distribute the design air quantity with no objectionable drafts, while maintaining not more than 50 F. P. M. velocity in the occupied portion of the space.

B. Ceiling Diffusers:

1. Square Louvered Diffuser Face:

- a. Square housing, welded steel construction core of square concentric louvers, removable at face of diffuser, round duct connection, with borders suitable for lay-in ceiling tile application.
- b. Diffuser Patterns: Fixed louver face for 1, 2, 3, or 4 direction air flow, direction indicated on drawings.
- c. Finish: Matte white finish.
- d. Manufacturers: Krueger SH (SHR for round neck)

2. Linear Diffusers:

- a. Linear diffusers shall be horizontal continuous slot type with multiple slots per the schedule and drawings. Construction shall be extruded aluminum with 1/2", 3/4" or 1" slots. The diffusers shall have integral devices to equalize air flow over the entire length of the diffuser.
- b. Multiple sections of diffusers shall be installed in a continuous arrangement, the butt ends shall be provided without flanges to provide a continuous effect. Multiple sections shall be aligned and fastened with alignment pins and slots or a similar method.
- c. Linear diffusers shall be provided with adjustable vanes to provide horizontal, vertical or midway patterns of air diffusion. Finish as selected by Architect.

3. Round Cone Diffusers:

- a. Adjustable round cone diffuser, welded steel construction with round neck and removable inner assembly of cones.
- b. Air pattern shall be field adjustable from horizontal to vertical.
- c. Finish: Matte white finish
- d. Krueger RM2

C. Registers & Grilles:

1. Registers and grilles shall be steel construction, fixed single deflection type, with clips and/or flange holes and screws (as required by Architectural finishes) to secure registers to ceiling construction. Face bars shall be inclined 30 degrees. Registers and grilles shall be factory primed and painted with a baked-on white enamel finish.

2. Wall Supply Registers:

- a. Provide manufacturer's standard wall registers where shown; of size, shape, capacity, type of materials and components indicated.
- b. Register Materials: Steel construction: Manufacturer's standard stamped sheet steel frame and adjustable blades.
- c. Register Faces: Vertical Straight Blades: Horizontal blades, individually adjustable, at manufacturer's standard spacing.
- d. Register Patterns: Double Deflection: 2 sets of blades in face, rear set at 90 degrees to face set.
- e. Register Finishes: Aluminum Enamel: Air-dried aluminum enamel prime finish.

3. Ceiling Return Register (CR):

- a. Ceiling registers shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be

aluminum according to the model selected. The back pan shall be one piece stamped heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule.

- b. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H. Inside of back pan shall be painted flat black.
- c. Krueger 6490 Sq neck/6690 Rd. neck
- 4. Supply, Return, Exhaust and Transfer Grilles (SG, RG, EG & TG):
  - a. Grilles shall be available parallel to the long dimension of the grille. Construction shall be of steel with a 1 1/4-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.
  - b. Deflection blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°.
  - c. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H.
  - d. Krueger 880 & S85
- D. Manufacturers: Provide diffusers, registers and grilles of one of the following:

Anemostat	Price
Carnes Co.	Titus
Krueger	Tuttle & Bailey
Metalaire	Nailor Industries

## 2.5 FABRIC AIR DISPERSION SYSTEM

- A. Round fabric air dispersion system shall be constructed of FabricAir® Trevira CS 100 fabric. The fabric is a woven inherently fire retardant and permeable fabric complying with the following characteristics:
  - 1. Duct Shape: Round
  - 2. Fabric: 100% Inherently Flame Retardant Polyester
  - 3. Weight: 7.2 oz./yd<sup>2</sup> per ASTM D3776
  - 4. Shrinkage: Max. 0.5% per EN ISO 5077
  - 5. Color: STANDARD
  - 6. Temperature Range: -40°F and +176°F
  - 7. Base Permeability @ 0.5" WG: 2.28 CFM/SQFT per ASTM D737, shall be verified by the Frazier Permeability Test
  - 8. Fire Retardancy: Shall meet the requirements of NFPA 90-A, ICC AC167 and UL 2518
  - 9. Manufacturer shall provide a 10-year non-prorated warranty. Prorated warranties will not be accepted.
- B. System Fabrication Requirements
  - 1. The system is made with sewn in, but still removable, aluminum hoops. The rods support the shape of the fabric system by 180° (8"-48"), 120° (49"-60"), 90° (61"-68") and 60° (69"-80"). Hoops must be pre-installed from factory, no installation at sight. Diameter of hoops and distance between as specified by manufacturer.
  - 2. Elbows of 70° or more to have 2 hoops sewn in order to maintain shape.

3. Air dispersion shall be accomplished by dispersion through permeable fabric. Due to exact requirements of draft and NC requirements alternative flow models are not acceptable.
4. The system shall be made of permeable fabric. Base permeability of fabric shall be reached based on a combination of weave construction and a thermo fixation process in order to prevent permeability degradation after wash. Fabric permeability based on a calendering process is not acceptable.
5. Fabric system shall include connectors to attach to suspension system listed below.
6. Provide system in sections optimized for maintenance, connected by zippers. Zippers shall provide closure completely around the circumference to prevent leakage. Required number of zippers shall be specified by the manufacturer.
7. Each section to have a unique tag including information about manufacturers order number, position, diameter of section, length of section, maintenance instruction, code compliance and contact details for spare parts.

C. Design Parameters

1. Use fabric air diffusers only for positive pressure air distribution.
2. Do not use fabric air diffusers in concealed locations.
3. Fabric diffusers shall be designed to a maximum of 3" water gauge, with 0.5" being the standard.
4. Design temperatures shall be between -40°F and +176°F
5. Manufacturer shall approve all technical design parameters.

D. Hangers and Supports

1. Type 8: One row H-rail/cable system located 2" above 12 o'clock of FabricAir® system. Hardware to include H-rail joint, eye bolt, end cap H-rail, cable, tie down strap and H-rail as required. FabricAir® system shall be attached to hardware using one single row of plastic sliders located 12 o'clock spaced 20 inches.
2. Hardware
  - a. Anodized Aluminum H-Rails - With PVC coated Galvanized Steel suspension cable. Suspension cable clamps, H-rail suspension eyebolts, and all other factory supplied metal components shall be Galvanized Steel.
  - b. PVC Coated Galvanized Steel Tensioning and Suspension Cable - Cable clamps, cable tensioners, and all other factory supplied metal components shall be Galvanized Steel.

E. Manufacturers: Fabric Air Inc, Duct Sox by Fabric Air Dispersion Products, or KE Fibertec.

2.6 ROOF-MOUNTED RELIEF HOODS

- A. Heavy gauge aluminum construction.
- B. Hinged hood.
- C. Hood underside insulated with 1" fiberglass
- D. Aluminum insect screen
- E. Provide 12-inch-high insulated roof curb.
- F. Manufacturers: Penn Ventilator Co., "Airette", Carnes Co., Greenheck, Loren Cook or Acme

2.7 PREFABRICATED ROOF CURBS AND EQUIPMENT SUPPORTS

- A. Factory fabricated by the manufacturer of the respective roof-mounted equipment when available and capable of meeting the following requirements:
  1. Thermally and acoustically insulated, rubber isolating pads.

2. Built to suit slope of roof and type of roofing; i.e. standing metal seam with integral cant strip and flashing extension.
  3. 8" to 12" height unless otherwise indicated.
  4. Support rails shall be aluminum, or sheet steel, with continuous wood nailer and removable counterflashing.
- B. Curbs shall be a product of a custom manufacture in the following cases:
1. Curbs as specified are not available from the respective equipment manufacturer.
  2. Piping or ducts penetrating roof.
  3. Prefabricated equipment supports are required.
  4. Step flashing assembly, EPDM for normal use and silicone for pipe temperatures above 200°F stainless steel clamp, suitable for single or multiple pipes.
- C. Pipe supports shall be a product of a custom manufacture equal to Pipe Prop as made by JMB Industries, or Anvil International Haydon H-Block.
- D. Manufacturers: Pate, Shipman, Custom Curb, Portals Plus, Lloyd Industries, Inc., PHP Systems/Design.

## 2.8 ROOF-MOUNTED INTAKE/EXHAUST VENTILATORS

- A. Heavy gauge aluminum construction.
- B. Hinged hood.
- C. Hood underside insulated with 1" fiberglass.
- D. Aluminum insect screen.
- E. Provide 12-inch-high insulated roof curb with blocking.
- F. Manufacturers: Penn Ventilator Co., Carnes Co., Greenheck, Loren-Cook or Acme.

## 2.9 SOUND ATTENUATION

- A. Provide silencers of the types and sizes shown on plans.
- B. Materials and Construction:
  1. Outer casings of rectangular silencers shall be made of 22-gauge galvanized steel in accordance with ASHRAE Guide recommended construction for high pressure rectangular duct work. Seams shall be lock formed and mastic filled.
  2. Outer casings of tubular silencers shall be made of galvanized steel.
  3. Interior partitions for rectangular silencers shall be made of not less than 26 gauge galvanized perforated steel.
  4. Interior construction of tubular silencers shall be compatible with the outside casings.
  5. Filler material shall be of inorganic mineral or glass fiber of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5 % compression to eliminate voids due to vibration and settling. Material shall be inert, vermin and moisture-proof.
  6. Combustion rating for the silencer acoustic fill shall be not less than the following when tested in accordance with ASTM-E-84, NFPA Standard 255 or UL No. 723:

Flamespread Classification	25
Smoke Development Rating	15
Fuel Contribution	20

7. Airtight construction shall be provided by use of a duct sealing compound on the job site. Material and labor furnished by contractor. Silencers shall not fail structurally when subjected to a differential air pressure of 8 in. w.g. inside to outside of casing.
- C. Acoustic Performance: Silencer ratings shall be determined in a duct- to-reverberant room test facility which provides for airflow in both directions through the test silencer in accordance with ASTM Specification E-477. The test set-up and procedure shall be such that all effects due to end reflection, directivity, flanking transmission, standing waves and test chamber sound absorption are eliminated. Acoustic ratings shall include Dynamic Insertion Loss (DIL) and Self- Noise (SN) Power Levels both for Forward Flow (air and noise in same direction) and Reverse Flow (air and noise in opposite directions) with airflow of at least 2000 fpm entering face velocity.
- D. Aerodynamic Performance: Silencer shall be of the low static pressure loss type. Airflow measurements shall be made in accordance with ASTM specification E-477 and applicable portions of ASME, AMCA and ADC airflow test codes. Tests shall be reported on the identical units for which acoustic data is presented.
- E. Certification: With submittals, the manufacturer shall supply certified test data on Dynamic Insertion Loss, Self-Noise Power Levels, and Aerodynamic Performance for Reverse and Forward Flow test conditions. Test data shall be for a standard product. All rating tests shall be conducted in the same facility, shall utilize the same silencer, and shall be open to inspection upon request from the Architect/Engineer.
- F. Manufacturers: Industrial Acoustics Co., Rink, Commercial Acoustics, Dynasonics, BRD, Vibro-Acoustics, Price.

### **PART 3 – EXECUTION**

#### **3.1 DUCTWORK**

- A. Dimensions on drawings are inside dimensions. Sheet metal dimensions shall be increased to suit thickness of acoustic duct lining, if applicable. Ductwork that is lined with acoustic lining is insulated.
- B. Ducts shall be concealed unless otherwise indicated.
- C. Changes in direction shall be made with radius bends or turning vanes.
- D. Supports shall be galvanized steel for steel ductwork and aluminum for aluminum ductwork.
- E. Locate ceiling air diffusers, registers, and grilles on "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.
- F. Do not install ductwork directly above any electrical equipment.
- G. Ductwork shall be supported per SMACNA Standards except as follows:
  1. Rivet or screw to side of duct when using flat strap hangers. Rivet or screw to bottom of duct when using trapeze hangers.
  2. Extend hangers down the side of the duct at least 9"; pass hangers under ducts less than 9" deep.
  3. Space hangers not more than 8' on centers for ducts up to 18" wide and 4' on centers for ducts over 18" wide.
  4. Wire hangers are not acceptable.
  5. Support ductwork from building structure with expansion bolts, rods, steel angles or channels installed to meet existing or new building conditions.
  6. Drilling into the roof deck is not permitted.
  7. Driving nails into anchors is not permitted.

- H. Air Flow Control:
    - 1. Major take-offs: Install volume control dampers.
    - 2. Branches: Install volume control dampers in all branches and at tap in branch take-off connections.
    - 3. Elbows: Use unvaned elbows with throat radius equal to width of duct and full heel radius; provide turning vanes where full throat and heel radius are not possible.
    - 4. Transitions: Make transitions in ducts as required by structural or architectural interferences.
      - a. Proportion airways to compensate for any obstructions within duct.
      - b. Avoid dead ends and abrupt angles.
      - c. Do not exceed 15 degrees slope on sides of transitions.
  - I. For all exterior single wall, square or rectangular ductwork, ensure that the top of all horizontal ductwork is crowned to minimize accumulation of weather on top of the finished insulation system jacket specified in Section 230230.
  - J. Ductwork on the roof shall be supported by an engineered, prefabricated hanger system specifically designed for installation on the roof without roof penetrations, flashing or damage to the roofing material. The system shall consist of bases made of high density polypropylene plastic with additives for UV protection, hot dipped galvanized structural steel frames, hangers, fasteners, rods, etc. The system shall be completed and designed to fit the ductwork installed under actual conditions of service. The system shall be furnished as manufactured by PHP Systems & Design or Anvil International Haydon H-Block. (Designer Choice)
- 3.2 FLEXIBLE AIR DUCT
- A. When flexible duct is used for final connection between duct mains on branches and diffusers on registers. The maximum length of flexible ductwork shall be 5'-0" in length.
  - B. Flexible ductwork shall be properly hung at the tap collar in order to prevent eventual wear and damage to the flexible duct.
  - C. The ceiling tile system should not be considered a support on which to lay flexible duct. Refer to SMACNA Standards for proper installation.
- 3.3 DUCT SYSTEM LEAK SEALING
- A. Joints in duct systems at duct heaters, air monitors, fire dampers, sound traps, supply air terminals including air handling light fixtures, shall be sealed to prevent air leakage.
  - B. All duct joints and seams in medium pressure and high-pressure duct systems shall be sealed to SMACNA Seal Class" A" Standards to prevent air leakage.
  - C. In the event there is in excess of 5% air leakage indicated in low pressure duct systems, it shall be the Contractors responsibility to seal the duct system. The amount of sealing necessary shall be that required to obtain the design air quantity at each terminal.
  - D. Duct sealing shall be by means of high velocity duct sealants such as Hardcast and/or Neoprene gaskets. Type of sealant and method of application shall conform to recommendations in SMACNA high velocity duct construction standards.
- 3.4 DUCTWORK TESTING
- A. The following duct systems shall be pressure leak tested:
    - 1. Supply ductwork
    - 2. Return ductwork
    - 3. Exhaust ductwork

4. Outside air intake ductwork
  - B. Pressure leak test the following:
    1. 10% of all ducts (Large Projects)
    2. 100% of all major equipment (ERUs, RTUs, AHUs, EFs, etc.)
  - C. All tests shall be conducted in accordance with AABC National Standards.
  - D. Ducts to be tested at 100% maximum of static pressure before any duct is insulated externally and concealed in accordance with SMACNA Standards.
  - E. Calculate the allowable leakage using leakage factor of 5% of Design Air Flow.
  - F. Select a limited section of duct for which the estimated leakage will not exceed capacity of the test apparatus.
  - G. Connect the blower and flow meter to the duct section and provide temporary seals at all openings of the ductwork.
  - H. Start the blower motor with the inlet damper closed. Increase pressure until the required level is reached.
  - I. Read the flow meter and compare the leakage in cfm. Reading should be 5% or less of design flow for the duct segment being tested.
  - J. If reading is more than 5% of design flow, depressurize duct, repair all leaks and retest until 5% or less of design flow is obtained.
  - K. Complete test reports and obtain Owner's witness signature.
  - L. Remove all temporary blanks and seals.
  - M. Warning: Do not overpressure duct.
- 3.5 EQUIPMENT
- A. Test apparatus shall consist of an airflow measuring device, flow producing unit, pressure indicating devices and accessories necessary to connect the metering system to the test specimen.
  - B. The Contractor conducting tests shall arrange for or provide all temporary services, all test apparatus, all temporary seals and all qualified personnel necessary to conduct the specified testing.
  - C. Test apparatus shall be accurate within plus or minus 7.5% at the indicated flow rate and test pressure and shall have calibration data or a certificate signifying manufacture of the meter in conformance with the ASME Requirements for Fluid Meters. Verification of above, to be supplied to Owner upon request.
  - D. Pressure differential sensing instruments shall be readable to 0.05" scale division for flow rates below 10 cfm or below 0.5" w.g. differential. For flows greater than 10 cfm scale divisions of 0.1" are appropriate. U-tube manometers should not be used for reading less than 1" of water.
  - E. Liquid for manometers shall have a specific gravity of 1 (as water) unless the scale is calibrated to read in inches of water contingent on use of a liquid of another specific gravity, in which case the associated gauge fluid must be used.
  - F. Instruments must be adjusted to zero reading before pressure is applied.
- 3.6 TEST REPORT
- A. Log the project and system identification data.
  - B. Enter the fan CFM, the test pressure, and the leakage class specified by the designer.
  - C. Enter an identification for each duct segment to be tested.
  - D. Calculate the allowable leakage factor. Enter this number on the report for each test segment.

- E. Conduct and record the field tests. If the sum of the CFM measured is less than or equal to the sum of the allowable leakage, the test is passed. Record the date(s), presence of witnesses and flow meter characteristics.
  - F. Maintain a mechanical duct plan of all tested duct segments. Plan to include duct segment identification and dates tested.
  - G. Test reports shall be submitted as required by the project documents.
- 3.7 LABELING
- A. At all fire damper locations, access doors in ductwork shall be identified with a permanent placard of red-white-red laminated commercial grade plastic construction, minimum one-half inch high capital letters, reading, "FIRE DAMPER" as appropriate for the installation. Attach securely to face of access door with brass screws at each corner, sealed airtight.

END OF SECTION 23 0600



## SECTION 23 0605

### FANS

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. 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.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.
- D. Refer to Section 230615 for Airflow Measurement Devices (Designer Choice)

##### 1.2 DESCRIPTION OF WORK

- A. This Section includes labor, material, equipment and supervision to provide a complete air distribution system as specified herein and as shown on drawings.
  - 1. Fans (Utility Set Type)
  - 2. Roof-Mounted Exhaust Fans
  - 3. Vertical Discharge exhaust Fan (Kitchen, Dishwashing, Laboratories, Fume Hoods)

##### 1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. Requirements established within the portions of the Project Manual titled Division 1, General Requirements, are collectively applicable to the work of this section.
- C. IMC (International Mechanical Code)
- D. SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.)
- E. American Society of Heating, Refrigerating and Air Conditioning Engineers' recommendations in ASHRAE Guide shall apply to this work.
- F. UL (Underwriter's Laboratories, Inc.)
- G. NFPA 90A shall apply to this work.
- H. State Fire Prevention Regulations.

##### 1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this Section.
- B. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer's written instructions.

##### 1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 230200.
- B. Submit the following:
  - 1. Shop drawings of all sheet metal. Indicate all steel, piping, conduit, and Architectural/Structural features to demonstrate complete coordination. Scale shall not be less than 1/4" = 1'-0".
  - 2. Manufacturer's literature and performance data of all equipment and devices.

## 1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents and as described within the specifications. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, they shall be responsible for any and all additional costs associated with the changes required by other trades.

## 1.7 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

## **PART 2 – PRODUCTS**

### 2.1 FANS (UTILITY SET TYPE)

- A. Utility set type fans shall be completely assembled units consisting of a continuously welded steel scroll housing, centrifugal fan wheel, structural steel base and motor combination with inlet and outlet flanges prepunched.
- B. Fan wheel shall be multi-blade type with hub and backplate and inlet ring. Entire fan wheel assembly shall be steel or aluminum. Fan blades shall be forward or backward inclined type. Wheel shall be statically and dynamically factory balanced.
- C. Scroll housing shall be steel with adjustable discharge feature. Inlet cone shall be spun steel with streamline venturi characteristic. Access door shall provide inspection of wheel and fan interior, fully hinged with multiple closures.
- D. Fan motor shall have copper windings and be grease packed ball bearing type of construction.
- E. Fan wheel shall be indirectly driven through a V-belt drive, and the drive shall be designed for 150% of the driven load and the motor pulley shall be adjustable pitch type. Fan shaft shall be ASTM A-108 steel, grade 1018 or 1045.
- F. Fans on roof shall be provided with a hinged weather hood over motor and drive, and a drain connection in bottom of scroll housing. The weather hood shall also protect a disconnect switch which shall be factory mounted by the fan manufacturer. Hood shall be vented to reduce heat build-up.
- G. Fans shall bear the AMCA seal and shall be manufactured by Acme, Aerovent, American Coolair/ILG, Buffalo Forge, Hartzell, Loren-Cook, Temtrol, Twin City Fan.

### 2.2 ROOF-MOUNTED EXHAUST FANS

- A. Aluminum casing shall be heavy gauge, mill finish of spun construction, weatherproof, removable, with aluminum birdscreen.
- B. Aluminum centrifugal fan, adjustable V-belt drive selected for 150% of motor ampere rating.
- C. Fans shall be quiet operating, selected for sound level below that of the space ventilated.
- D. Accessories: Disconnect switch, insulated roof curb.
- E. Manufacturers: Penn Ventilator Co., Greenheck, Loren Cook, Acme, Carnes, Breidert, Hartzell.

### 2.3 VERTICAL DISCHARGE EXHAUST FAN (KITCHEN, DISHWASHING, LABORATORIES FUME HOODS)

- A. The exhaust fan shall be a vertical discharge, roof-mounted, power ventilator with heat, vapor and fume resistant features.

- B. The casing shall consist of base curb cap, ventilated motor compartment, and upper and lower exterior wind bands. The casing shall be of mill finish aluminum of spun construction.
- C. Fan wheel shall be centrifugal backward curved type constructed of aluminum. Back plate of fan wheel shall be finned to provide forced cooling of the motor compartment.
- D. An insulated heat shield shall separate the ventilated motor compartment from the air stream, and a shaft seal shall prevent seepage of heat and fumes from around the shaft into the motor compartment.
- E. The fan shaft shall be motor driven through a V-belt drive which shall be adjustable by varying the pitch diameter of the motor pulley. The drive shall be provided with a safety factor equal to 150% of the motor ampere nameplate rating. Provision shall be made for adjusting the V- belt tension.
- F. A disconnect safety switch shall be mounted under the removable motor dome. The fan motor shall have copper windings.
- G. The fan shall be provided with a bird guard constructed of stainless steel expanded metal.
- H. Provision shall be made in the unit design for ready access for cleaning and for serving all components and accessories. Provide hinged curb cap with stay brace to fit onto curb.
- I. An integral grease trough shall be provided on the fan base for applications on Type I kitchen ventilators, as well as a vented curb extension.
- J. Special motors for high heat and explosion-proof shall be provided where indicated in the schedule.
- K. The exhaust fan unit shall be AMCA certified and shall be as manufactured by Penn Ventilator Company, Loren Cook, CaptiveAire, Greenheck, American Coolair/ILG, Breidert, Hartzell.

### **PART 3 – EXECUTION**

#### **3.1 FANS, EQUIPMENT AND ACCESSORIES**

- A. Install in accordance with manufacturer's details and instructions.
- B. Mount fan speed control at the fan to facilitate mechanical balancing. Power wiring shall be part of the work of Division 26.
- C. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.
- D. Install units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- E. Support: Install and secure roof curb structure, in accordance with National Roofing Contractor's Association (NRCA) installation recommendations and shop drawings. Install and secure units on curbs and coordinate roof penetrations and flashing.
- F. The Mechanical Contractor shall own as a part of his work, the following:  
Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION 23 0605



**SECTION 23 0760**  
**AIR HANDLING EQUIPMENT**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.
- D. Refer to Section 230450 for Refrigeration Equipment – HVAC.

1.2 DESCRIPTION OF WORK

- A. This Section includes work necessary and/or required and materials and equipment for construction of a complete system. Such work includes, but is not limited to the following:
  - 1. Rooftop Packaged Air Conditioning Unit
  - 2. Packaged Air-to-Air Energy Recovery Unit
  - 3. Rooftop Air Handlers

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. AMCA Standards 210 and 300 for fans.
- C. ARI Standard 410, ASHRAE Standard 33 for Heating and Cooling Coils.
- D. ASHRAE Standard 52.2 and U.L. Standard 900 for media type air filters.
- E. AMCA Standard 511 and 500D for Air Control Dampers.
- F. AMCA Standard 611 and 610 for air flow measurement stations.
- G. ARI Standard 1060 and ASHRAE Standard 84 for Air-to-Air Energy Recovery Equipment.
- H. ARI Standard 260 and 430 for Air Handling Units.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this Section.
- B. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer's written instructions.

1.5 SUBMITTALS

- A. Submit shop drawings in accordance with Section 230200.
- B. Submit shop drawings and descriptive data for all equipment specified in this section.

1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items provided by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this

Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

#### 1.7 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements. In addition, the following special guarantee applies:
  - 1. Each compressor unit shall be provided with manufacturer's five (5) year parts and labor warranty.

### **PART 2 – PRODUCTS**

#### 2.1 ROOFTOP PACKAGED AIR CONDITIONING UNIT

- A. Provide a one-piece, curb-mounted, air-to-air electric packaged cooling unit. Unit shall be completely assembled, and tested complete with refrigerant charge and ready to operate. The total unit shall be UL listed and carry a UL label.
- B. Unit compressor(s) shall be welded, fully hermetic with crankcase heater(s) and suitable vibration isolators. The standard unit shall be capable of operating down to 45 degrees F (OA) on a cooling cycle. Compressors shall have a 5-year parts and labor warranty.
- C. Indoor and outdoor coils shall be of non-ferrous construction with aluminum fins mechanically bonded to seamless copper tubes with all joints brazed.
- D. Indoor air fan shall be forward-curved, centrifugal. Motor shall have permanently lubricated bearings. Outdoor fan shall be of the propeller type with direct driven, totally enclosed, permanently lubricated motor.
- E. Unit cabinet shall be constructed of 14-gauge galvanized steel, bonderized and coated with a baked enamel finish. Cabinet interior shall be insulated with 1/2" thick neoprene coated fiberglass. Cabinet panels shall be easily removable for service to all operating components. A condensate drain for the indoor coil shall be provided. Condenser coils and fan discharge shall be protected by heavy duty wire guards.
- F. The cooling system shall be protected with low-pressure switch, loss-of-charge protection, indoor coil freezestats and current and temperature sensitive overload devices. Each of these devices shall be wired to prevent compressor restart until reset at the thermostat.
- G. Cabinet shall contain suitable openings for routing of all utility connections.
- H. Filters: 2" thick disposable type, MERV 8. Provide two (2) sets.
- I. Compressor shall not short cycle as a result of a rapid change in thermostat setting.
- J. Roof curb shall be of the same manufacture as unit and shall include an insulated panel under compressor section to prevent condensation forming on the bottom. Roof curb shall be a minimum of 16" high.
- K. Provide economizer control which shall include R.A. and low-leak O.A. dampers and barometric relief damper, outdoor air filters and hood, and fully modulating electric control system with O.A. thermostat and mixed air thermostat. Economizer control shall be capable of introducing up to 100% outdoor air. The control changeover from mechanical cooling to economizer operation shall be fully automatic thru an adjustable outdoor air changeover thermostat. Economizer shall be integrated type capable of simultaneous compressor and economizer operation for maximum benefit of outdoor air.
- L. Electrical: 460 volt, 3 phase, 60 Hz; electrical features shall include single point power feed termination, unit-mounted lockable disconnect, internal circuit breaker type overload protection, starters, 24 VAC control transformer and fusing.

- M. Thermostat: Provide 24V programmable thermostat, with battery back-up for clock, system and fan switches.
    - 1. Option: Provide conventional thermostat interface with marked positions on unit terminal strip.
  - N. Manufacturers: York/Johnson Controls, Trane, Carrier, Daikin McQuay
    - 1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.
- 2.2 PACKAGED AIR-TO-AIR ENERGY RECOVERY UNIT
- A. Factory fabricated and assembled unit consisting of constant volume fans, motors, and drive assemblies, coils, plenum casing, filters, energy recovery wheel (with motor and drive), motor-operated outside air and exhaust air dampers, access doors and operating controls.
  - B. Casing:
    - 1. Casing panels shall consist of dual wall, minimum 18-gauge galvanized solid exterior skins and 22-gauge galvanized steel solid interior skins enclosing 2" thick 1.5 pcf fiberglass insulation with a minimum R-value of 10 which meets NFPA 90A and UL181 test standards. All metal-to-metal surfaces exposed to the weather shall be sealed airtight with maximum leakage not-to-exceed 2% at external static pressure of 3" W.C.
    - 2. Removable panels shall be provided for energy recovery wheels, and fans. The housing shall be supported by an all-welded epoxy-painted structural base. Lifting lugs shall be welded to the base. All frame and panel members shall be G90 galvanized steel.
    - 3. Access to all internal devices and sections shall be provided through hinged, sealed doors. Access doors shall be constructed of the same materials as the unit casing. Each door shall be provided with two cam type handles and two heavy duty hinges to achieve maximum sealing. Handles are to be internal and external for opening from the inside or outside of the unit.
    - 4. The unit's duct connections shall be arranged to require only minor ductwork offsets or transitions to the packaged heating/cooling unit.
    - 5. Unit features and casing shall be of weatherized construction including:
      - a. Continuous 18 gauge galvanized steel, pitched watertight roof with standing seams.
      - b. Gasketed sections requiring no caulking at the job site.
      - c. Internal galvanized steel drain pans in each section.
    - 6. Provide cabinet extensions adjacent to each coil section of sufficient size to accommodate piping, valves and accessories as detailed on the drawings. Cabinet extensions shall be an integral part of the unit and its support curb, equal in construction, with openings down through the roof deck to allow building air to penetrate the compartment.
  - C. Fans:
    - 1. Fan ratings are based on tests made in accordance with AMCA Standard 210 and shall bear the AMCA Seal. Fans shall be of the centrifugal type, designed with a scroll type housing. Fans shall incorporate a wheel, structural steel frame and shaft and bearings in the AMCA Arrangement 3 configuration to form a heavy duty integral unit. All fan wheels shall provide stable flow and high rigidity. The wheels shall be non-overloading type. The blades shall be continuously welded, die-formed backward curved type, designed for maximum efficiency and quiet operation. Impellers shall be statically and dynamically balanced and the complete fan assembly shall be test balanced at the operating speed prior to shipment.

2. Shafts shall be AISI hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy. Shafts shall be sized for first critical speed of at least 1.43 times the maximum speed for the class.
  3. Bearings shall be heavy duty, grease lubricated, anti-friction ball or roller, self-aligning, pillow block type and selected for minimum average bearing life (AFBMA L-10) in excess of 100,000 hours at the maximum class RPM.
  4. Fans shall be mounted on vibration bases with adjustable motor bases, V-belt drives, minimum 1" static deflection spring isolators, and flexible connections. Belts shall be designed for a minimum 1.5 service factor. Drives for motors shall be variable pitch.
  5. Motors shall be standard NEMA frame, design B high efficiency, with 1.15 service factor and open drip-proof enclosures. Motor selections shall be non-overloading over the fan curve from 0 to 150% of design flow, and the design BHP shall not be above 90% of motor horsepower at design condition.
- D. Total Energy (Enthalpy) Recovery Wheel:
1. The rotor media shall be made of aluminum which is coated to prohibit corrosion. All media surfaces shall be light weight polymer coated with a permanently bonded Silica gel desiccant prior to being formed into the honeycomb media structure to ensure that all surfaces are coated and that adequate latent capacity is provided. Desiccant coatings that must be reapplied over time are not acceptable.
  2. Sensible and latent recovery efficiencies shall be clearly documented through a certification program conducted in accordance with ASHRAE 84-1991 and the results shall be presented in accordance with ARI 1060-2000 Standards. The certification shall have been conducted by the unit manufacturer.
  3. Wheel testing to document that the desiccant material utilized does not transfer pollutants typically encountered in the indoor air environment shall be provided. The cross-contamination and performance certification reports shall be provided for as part of the submittals for this project.
  4. The media shall be cleanable with low temperature steam, hot water or light detergent, without degrading the latent recovery. Dry particles up to 650 microns shall pass freely through the media.
  5. Rotor System:
    - a. Seals: The rotor shall be supplied with diameter and perimeter seals which shall not make contact with any rotating surface of the exchanger rotor face.
    - b. Rotor Support System: The rotor media shall be provided in segmented fashion to allow for field erection or replacement of one section at a time without requiring side access. The media shall be rigidly held by a structural spoke system made of stainless steel.
    - c. Rotor Housing: The rotor housing shall be a structural framework which limits the deflection of the rotor due to air pressure loss to less than 1/32". The housing shall be made of galvanized steel to prevent corrosion. The rotor shall be supported by two pillow block bearings which can be maintained or replaced without the removal of the rotor from its casing or the media from its spoke system. Bearings shall be selected for an L-10 life in excess of 30 years.
    - d. Drive System: The rotor shall be driven by a self-adjusting flexible, circumferential belt system. A/C motors shall be utilized.
    - e. Assembled system shall incorporate the complete wheel assembly, seals, drive motor and belts in an insulated cassette frame within a slide-out track.

- E. Filters:
  - 1. Provide filters for both inlet air streams, outside air and return air..
  - 2. Filters shall be disposable 2" thick, MERV 8. The filter shall be listed by Underwriters' Laboratories as Class 2.
  - 3. Provide a bank of galvanized universal holding frames arranged for upstream access.
- F. Electrical: 460 volt, 3 phase, 60 Hz; electrical features shall include single point power feed termination, unit-mounted lockable disconnect, internal circuit breaker type overload protection, starters, 24 VAC control transformer and fusing.
- G. Connections: System field connections shall be limited to:
  - 1. Supply air duct connection from the packaged unit.
  - 2. Return air duct connection to the packaged unit.
  - 3. Field supplied power source.
  - 4. Twisted pair, ATC communications wiring.
  - 5. Coil piping connections for water system piping and condensate drain.
- H. Coil Section:
  - 1. Provide coil section with auxiliary cooling and heating coils to maintain scheduled air conditions leaving the unit.
  - 2. Condensate drain pan shall be constructed of galvanized steel.
  - 3. Heating and Cooling Coils:
    - a. Coils shall be furnished to meet the performance requirements set forth in the schedule. All coils shall have performance certified in accordance with ARI Standard 410.
    - b. Coil casing to be constructed of 16-gauge galvanized steel with aluminum die-formed corrugated fins and guide channels to create turbulent wiping behind the tubes with collars drawn and belled. The copper tubes are to be firmly bonded to the fins by mechanical expansion.
    - c. Drainable water coils shall be designed to operate at 250 psig design working pressure and up to 200°F and shall be tested with 325 psig compressed air under water. Circuiting shall provide free draining and venting when installed, counter flow of air and water, with water velocities not to exceed 7 feet per second and without exceeding the water pressure drops scheduled. All coils must have same end connections regardless of the number of rows deep. Provide a ¼" FPT, plugged vent or drain tap on each connection.
    - d. Coil connection shall stub through the interior partition wall between the supply and return air tunnels. Field piping to the coils shall extend down through the bottom pan of the unit within the unit roof curb. Pipe sleeves shall be sealed airtight.
- I. Roof Curb: Prefabricated galvanized steel mounting curb shall be provided for field assembly on the roof decking prior to unit placement. The roof curb shall be a perimeter type with complete perimeter support of the air handler unit. The curb shall be a minimum of 12" high. Gasketing shall be provided for field mounting between the unit base and roof curb. Curb shall include a 2" x 4" wood nailer.
- J. Manufacturers: Basis of design, Greenheck. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are limited to one of the following:
  - Addison
  - Annexaire

Innovent

Temtrol

Valent

VenMar

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

### 2.3 ROOFTOP AIR HANDLERS

- A. Units shall be completely factory assembled and tested. Outside air, return air, exhaust air systems, fans, motors and all operating and safety controls specified shall be furnished, factory installed and factory tested.
- B. The unit's cooling, heating, humidifying, ventilating, and exhausting capacity and performance shall meet or exceed that shown on the schedule.
- C. The air handlers shall be specifically designed for outdoor application. Units shall be designed for roof curb mounting. Weatherized indoor air handlers are not acceptable.
- D. Tags and decals to aid in service or indicate caution areas shall be provided. Electrical wiring diagrams shall be attached to the control panel access doors. Installation and maintenance manuals shall be supplied with each unit.
- E. Base and Frame:
  1. Units shall have a base assembly manufactured of structural steel members, electrically welded to form a rigid equipment mounting structure. All major components shall be supported from the base. Formed sheet metal structural members are unacceptable.
  2. The unit construction shall include an electrically welded upper frame, fabricated of structural steel tubing. This upper frame shall be welded to the unit structural steel assembly and shall be painted with a rust inhibiting enamel. Cabinets constructed of formed sheet metal posts and panels, screwed or otherwise fastened together without an inner frame are unacceptable.
  3. The unit base shall overhang the roof curb for water runoff and shall have a fabricated recess with a continuous surface to seat on the roof curb gasket, providing a positive, weathertight seal.
  4. Integral lifting lugs shall be provided. Lifting lugs shall be suitable for use at unit tie-down points
  5. Units shipped in sections shall be designed for field assembly. Unit sections shall be flanged at the entire perimeter to provide a gasket surface. Matching holes shall be drilled in the flanges with nuts, screws, gasket, and washers provided.
- F. Cabinet:
  1. Exterior panels shall be constructed of a minimum of 18 gauge galvanized steel formed panels.
  2. Interior double wall panels shall be constructed of minimum 20- gauge galvanized steel (choose solid or perforated).
  3. All panels shall be fastened to the unit frame with 1" square clips and self-tapping screws. Pop riveted or spot welded fastenings are not acceptable. All exterior panel joints shall be recessed, mastic coated, and covered with a removable panel cap. All exterior panel to panel joints shall be caulked for water and air tightness.
  4. Exterior casing screws shall be zinc chromate plated and shall have cup washers with neoprene grommets to prevent damage to the paint finish and to form a weathertight seal.

5. The unit roof shall have a minimum pitch of 1/2" per foot. Rain drip lips shall be provided above the access doors. The exterior panels and doors shall form essentially smooth, continuous surfaces for a pleasing appearance.
6. All exterior panels, the top, and the base shall be insulated with a minimum of 1" thick, 1-1/2 lb/ft. fiberglass insulation glued in place. Smoke and flame spread ratings shall be in accordance with NFPA 90A. Polyurethane and polystyrene insulations are not acceptable.
7. Man-size hinged access doors shall be provided and arranged to permit ready access to all internal components. Doors shall have a minimum of 3 galvanized hinges and 2 high compression latches with handles. Doors shall be insulated double wall type construction with corners welded and ground smooth. Door gasketing shall be closed cell polyvinyl chloride foam type.
8. The entire exterior and interior of the unit shall be completely cleaned and finished with an air-dried enamel which meets or exceeds Federal Specifications TTP636 exposure requirements.
9. Provide cabinet extensions adjacent to each coil section of sufficient size to accommodate piping, valves and accessories as detailed on the drawings. Cabinet extensions shall be an integral part of the unit and its support curb, equal in construction, with openings down through the roof deck to allow building air to penetrate the compartment.

G. Cooling and Heating Coils:

1. Cooling and/or heating coils shall be furnished to meet the performance requirements set forth in the schedule. All coils shall have performance certified in accordance with ARI Standard 410. Cooling coils shall be arranged in the unit for horizontal air flow and selected for a minimum face velocity not exceeding 600 fpm.
2. Coil casing shall be constructed of 16-gauge galvanized steel with aluminum die-formed corrugated fins and guide channels to create turbulent wiping behind the tubes with collars drawn and belled. The copper tubes shall be firmly bonded to the fins by mechanical expansion.
3. Drainable water coils shall be designed to operate at 250 psig design working pressure and up to 300 F and shall be tested with 325 psig compressed air under water. Circuiting shall provide free draining and venting when installed, counter flow of air and water, with water velocities not to exceed 7 feet per second and with exceeding the water pressure drops scheduled. All coils must have same end connections regardless of the number of rows deep. Provide a 1/4" FPT, plugged vent or drain tap on each connection.

H. Supply and Return Fans:

1. Fan performance shall be AMCA certified in accordance with AMCA Standard 210. Fans shall be selected to provide the air flow and pressure specified.
2. Fan shall be of the centrifugal type, statically and dynamically balanced and tested in the factory. The assembly shall use a turned, ground, and polished solid steel shaft selected so that the fan reaches its rated speed before the shaft passes through its first critical speed. The bearings shall be self-aligning, relubricatable ball bearings selected for minimum average bearing life (AFBMA L-10) in excess of 100,000 hours at the maximum class RPM. Bearing grease fittings shall be extended to the fan drive side.
3. Fan housings shall be constructed for heavy gauge and equipped with inlet cones designed for smooth air flow into the accompanying intake rim of the fan impeller. Plenum fans shall have personal protective screens on the outlet side of the fan.
4. The fan motor and fan assembly shall be mounted on a common base to allow consistent belt tension with no relative motion between the fan and motor shafts. This entire assembly shall be isolated from the unit base. The fan discharge shall be connected to the cabinet through a minimum 6" canvas flexible connection. V-belt drives shall be selected for not less than 150% of

- the connected driving motor. Sheaves shall have at least two grooves, selected to drive the fan at the required speed. Belts shall be matched sets. Options: DWDI FC fans, 2" spring isolators.
- I. Fan Motors: Shall be NEMA design ball bearing type with electrical characteristics and horsepower as specified. Motors shall be 1750 RPM, open dripproof type. The motor shall be located within the unit on an adjustable, heavy steel base. Options: Open dripproof of TEFC standard motors; and variable pitch drive sheave on 10 HP and under motors.
- J. Air Inlet Section:
1. The outside and return air section shall be designed to form a plenum. The outside and return air streams shall be directed into each other by the damper assemblies to facilitate good mixing of the air streams. Outside and exhaust air openings shall not be on the same side of the unit in order to minimize recirculation. Return/Relief air dampers shall be parallel blade, outside air damper shall be opposed blade.
  2. Damper assemblies shall be a low leak design. Damper blades shall be fabricated from a minimum of 16-gauge galvanized steel. Maximum blade length shall not exceed 48" Blade ends shall be sealed with spring steel seal and blade edge seals shall be extruded vinyl. The damper shafts shall be fabricated from 1/2" plated steel hex and mounted in frame with molded synthetic bushings. Damper air leakage shall not exceed 6 CFM per square foot at 4" W.G. static pressure.
  3. Outside and exhaust air openings shall be covered with rain hoods furnished with birdscreens. Or optional stormproof louvers with birdscreens shall be furnished. Damper velocities shall not exceed 2000 FPM on the outside and exhaust air dampers. Rain hood velocities shall not exceed 1000 FPM. Louver velocities shall not exceed 500 FPM on the outside air inlet and 1000 FPM on the exhaust air outlet.
- K. Air Blenders:
1. Provide blender section generally consisting of blenders in a flanged housing, ready for fit up to air handlers.
  2. Housing shall be constructed of 18-gauge steel, finished with corrosion resistant paint and zinc coating.
  3. Air blenders to be constructed of .080" thick aluminum.
  4. Air blenders to be securely fitted into section with adequate blank-off panels. Sections shall have 2" flanges all around the fit up to air handler and shall be lined with 1" Rubatex liner or equal.
  5. The complete mixing section shall be constructed with proper mixing distances such that the maximum temperature standard deviation through a plane parallel with blender at the discharge of the mixing section, shall be 6 deg. F when the difference between entering air stream is 60 degrees F. Likewise, the variation coefficient governing the velocity problem shall be no greater than .3 based on the equation: Variation coefficient = standard deviation divided by average velocity.
  6. Units to be manufactured by Blender Products, Inc., Denver, Colorado; Kees, Inc.
  7. Any manufacturer of static mixing devices shall have 15 years experience in the static mixing field with one 500 proven installation in active service.
- L. Panel Filters: Panel filters' frames shall be welded galvanized steel fabricated as an integral part of the unit. Filter face velocity shall not exceed that specified. Frame options: 2" angle filter banks, elements rated MERV 8.
- M. Coil Section: Shall be furnished with insulated drain pan with double wall stainless steel drain pan liner and threaded condensate drain connection on two sides. Adjoining coil sections shall be separated by an access section, minimum 12 inches deep with doors on each side.

- N. Filter Gauge: A Dwyer filter gauge across the filter bank shall be furnished and installed. The filter gauge shall be mounted flush on the unit exterior.
- O. Control Panel:
  - 1. Each unit shall be equipped with a control panel built as an integral part of the unit. Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with the requirements of the latest N.E.C. issue. Where applicable, U.L. listed components shall be used. Components shall be labeled and wires numbered per wiring diagram. Unit shall bear E.T.L. (Electrical Testing Laboratory) certification label.
  - 2. The control panel shall contain a three pole main power terminal, starter, contactors, three phase current overload protection, fuse blocks with fuses, numbered terminal strip, a line voltage to 115 volt control transformer with primary and secondary fuse and control circuit switch. Options: 115 volt to 24 volt control transformer; circuit breakers to replace fuses for each motor; and horsepower rated starters made by Allen Bradley or Square D.
  - 3. End devices for control functions shall be factory mounted and wired to a unit-mounted terminal strip for interface with the temperature control system. Each end device shall be appropriately labeled and identified on the terminal strip as to function, voltage, etc. Power shall be 120 VAC or 24 VAC as required by the control system.
- P. Unit-Mounted Disconnect Switch: Each unit shall be equipped with a mounted and wired non-fused disconnect switch to meet the N.E.C. requirement for "disconnecting means within sight of" the unit.
- Q. Roof Curb: Prefabricated galvanized steel mounting curb shall be provided for field assembly on the roof decking prior to unit placement. The roof curb shall be a perimeter type with complete perimeter support of the air handler unit. The curb shall be a minimum of 12" high. Gasketing shall be provided for field mounting between the unit base and roof curb. Curb shall include a 2" x 4" wood nailer.
- R. Manufacturers: Carrier, Daikin McQuay, Temtrol, Trane, USA Coil & Air, York/Johnson Controls.
  - 1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION**

- A. Verify that coils, filters, motors, drives and other components are matched with the proper unit.
- B. Assemble unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas, and paint in accordance with manufacturer's written recommendations.
- C. Vacuum clean interior of units prior to operation.
- D. Repair air leaks from or into casing that can be heard or felt during normal operation.
- E. Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- F. Support: Install and secure roof curb to roof structure, in accordance with National Roofing Contractor's Association (NRCA) installation recommendations and shop drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.
- G. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.

H. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

I. Provide certified factory start-up and written report on all units.

### 3.3 AUTOMATIC TEMPERATURE CONTROLS

A. Coordination of control work with the BAS shall include, but not be limited to, the following items as described in Section 230900: ATC.

B. Constant volume rooftop units:

1. The following items shall be provided by the equipment manufacturer:

- a. Motor starters and overload protection.
- b. Control transformers.
- c. Energy wheel motor, speed controller, defrost controller, rotation failure contact, and status contact.
- d. Dampers and damper motors.
- e. Terminal blocks for all wiring connections between equipment and control devices.
- f. Analog air filter differential pressure sensor.
- g. Manual reset freeze stat.
- h. Variable frequency drives as scheduled.
- i. Run status dry contact for each VFD.

2. The following items will be furnished by the BAS Contractor and installed by the equipment manufacturer:

- a. DDC Controller
- b. Discharge air temperature sensor.
- c. Discharge humidity sensor.
- d. Return air temperature sensor.
- e. Return air humidity sensor.
- f. Temperature sensor at exhaust air outlet.
- g. Current sensor for one phase of power feeding the supply fan, and/or unit exhaust fan.
- h. Mixed air average temperature sensor.
- i. Heating coil discharge air temperature.

3. The following items shall be field mounted and wired by the BAS Contractor:

- a. Discharge air temperature sensor.
- b. Discharge humidity sensor.
- c. Heating coil discharge air temperature sensor.
- d. Manual reset freezestat (supplied by ATC).

C. Rooftop Energy Recovery Units:

1. The following items shall be provided by the equipment manufacturer:

- a. Motor starters and overload protection.
  - b. Control transformers.
  - c. Energy wheel motor, speed controller, defrost controller and rotation failure contact.
  - d. Dampers and damper motors.
  - e. Terminal blocks for all wiring connections between equipment and control devices.
  - f. Analog air filter differential pressure sensor, each filter bank.
  - g. Manual reset freeze stat.
2. The following items will be furnished by the BAS Contractor and installed by the equipment manufacturer:
- a. DDC Controller.
  - b. Unit discharge air temperature sensor.
  - c. Heating and cooling coil discharge air temperature sensors.
  - d. Discharge humidity sensor.
  - e. Return air temperature sensor.
  - f. Return air humidity sensor.
  - g. Temperature sensor at exhaust air outlet.
  - h. Current sensor for one phase of power feeding the supply and exhaust fans.
3. The following items shall be field mounted and wired by the BAS Contractor:
- a. Discharge air temperature sensor.
  - b. Discharge humidity sensor.
  - c. Heating coil discharge air temperature sensor.
  - d. Manual reset freezestat (supplied by ATC).

- D. The factory mounted DDC controllers shall be fully programmed with factory approved applications. Any modifications to these programs shall be done by factory trained personal or as approved by the DDC controls and unit equipment manufacturer.

The unit equipment manufacturer shall provide coordination for start-up, check-out, and test of the factory mounted DDC controllers and network devices including the protocol translator. Any hardware and software necessary including labor shall be provided by the unit equipment manufacturer.

The unit DDC controllers shall be networked to a standard protocol translator or gateway so system points shall be available for communications and control from the Building Automation System (BAS)/Automatic Temperature Controls (ATC) System. The protocols available from the protocol translator to the BAS/ATC System shall be BACNET (MSTP), LON or N2.

System points shall be configured to the BAS/ATC System by the BAS/ATC System Contractor. The mapping of points to the BAS/ATC front-end/PC shall be done by the BAS/ATC Contractor. Any software or hardware necessary including labor to accomplish this work shall be provided by the BAS/ATC System Contractor.

END OF SECTION 23 0760



**SECTION 23 0900**  
**AUTOMATIC TEMPERATURE CONTROL**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Section 230200 and drawings are hereby made a part of this section as fully as if repeated herein.
- B. The Mechanical Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical.

**1.2 DESCRIPTION OF WORK**

- A. Provide labor, material and supervision necessary to install a complete direct digital control system of temperature controls to control all HVAC Systems, associated components and accessories as described herein.

**1.3 SUBMITTALS**

- A. Submit shop drawings and manufacturer's data sheets of all equipment.
- B. Submit manufacturer's certificates of conformance with applicable codes.
- C. Furnish point-to-point diagram of automatic temperature control system approval, including heating, ventilating and air conditioning equipment wiring diagrams where temperature control connections are required.
- D. Provide ten (10) copies of submittal data within thirty (30) days of contract award.
- E. Submittal shall consist of:
  - 1. System Architecture showing all digital and pneumatically actuated devices.
  - 2. Equipment lists of all proposed devices and equipment including data sheets of all products.
  - 3. Valve, damper and well and tap schedules showing size, configuration, capacity and location of all equipment.
  - 4. Data entry forms for initial parameters. Contractor shall provide English listing of all analog points with columnar blanks for high and low warning limits and high and low alarm limits, and a listing of all fan systems with columnar blanks for beginning and end of occupancy periods; and samples of proposed text for points and messages (for at least two systems of at least 15 points total) including sample 480-character alarm message. All text shall be approved prior to data entry.
  - 5. Wiring and piping interconnection diagrams including panel and device power and sources.
  - 6. Sketches of all graphics.

**1.4 QUALITY ASSURANCE**

- A. Insure that all work and equipment is installed in accordance with manufacturer's warranty requirements.
- B. Provide adequate supervision of labor force to assure that all aspects of specifications are being fulfilled.
- C. The system shall be engineered, programmed and installed by personnel trained and regularly employed by the control's manufacturer.

- D. Supplier shall have technical support to promptly respond within 24 hours or less to service calls to the site with technical staff, spare parts inventory and test and diagnostic equipment.
- E. Codes and Approvals:
  - 1. The complete system installation shall be in strict accordance with national and local electrical codes. All devices designed for or used in line voltage applications shall be UL listed.
    - a. All microprocessor based devices shall be UL916 listed.
    - b. All electrical environmental control and monitoring devices shall be UL429 and/or UL873 listed.
  - 2. All electronic equipment shall conform to the requirements of FCC regulation Class B, Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.
  - 3. The complete system shall conform to ANSI/ASHRAE Standard 135-2012, BACNET.
- F. All system components shall be designed and built to be fault tolerant.
  - 1. Provide satisfactory operation without damage at 100% above and 85% below rated voltage and at +3 Hertz variation in line frequency.
  - 2. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be A.C. coupled or equivalent so that any single device failure will not disrupt or halt bus communication.

#### 1.5 ELECTRICAL WIRING

- A. All electrical wiring, components and accessories in connection with the Automatic Temperature Control System shall be furnished and installed by the control's contractor.
  - 1. Electrical Contractor shall provide all wiring to duct smoke detectors.
  - 2. Unless stated otherwise in the design documents, the ATC Contractor is responsible for providing control power to all valves, actuators, devices and components within the DDC System regardless of the selected voltage of those devices. This also includes all 120 volt power circuits required for devices, panels and control equipment.
  - 3. The ATC Contractor shall be responsible for providing the control interface between terminal unit condensate pumps and their respective units at the required voltage of these devices in order to shut down the terminal unit in the event of high water level in the condensate pump receiver.
- B. Control wiring shall include all wiring necessary to interface with new controls, such as relays and transducers, and shall also include electric and electronic devices such as freezestats, electronic sensors, relays, flow switches and controlled devices such as valve and damper operators, both electric/electronic actuated devices. Pilot devices such as ON/OFF switches and thermostats installed in series with line voltage circuits shall be considered to be control wiring.

#### 1.6 AUTOMATIC TEMPERATURE CONTROL

- A. Provide a DDC System of automatic temperature control which shall be as manufactured by Alerton Technologies, Inc., as installed by Albireo Energy, Johnson Controls, Inc., as installed by Modern Controls, Inc., Staefa Control System as installed by Automatic Control Systems, Inc., Automated Logic Corp., as installed by Radius Systems, and Schneider EcoStruxure, as installed by Tri-M Group, LLC. The system shall be complete in all respects including labor, materials, equipment and services necessary.
- B. All electrical wiring in connection with the installation of the automatic temperature control system shall be furnished and installed under the direct supervision of the control manufacturer.

## **PART 2 – PRODUCTS**

### **2.1 TEMPERATURE SENSORS**

- A. Solid state room sensors shall be of the wire wound resistance type element. Sensors shall be equipped with visual readout and adjustment. Sensors shall be of the completely solid state type with no moving contacts. Printed circuit board under thermostat cover shall contain a low mass resistance type setpoint dial and amplifier. Provide test points for measuring output voltage. Sensors shall be direct or reverse acting as required for the sequence of operation.
- B. Sensors shall provide the application for night setback override.
- C. Sensors shall be mounted at ADA height (48" above floor).

### **2.2 SMOKE DETECTORS**

- A. Duct type ionization smoke detectors shall be furnished by the Electrical Contractor and installed by the Mechanical Contractor in the supply and return air stream. The Electrical Contractor shall provide wiring from each detector to the Fire Alarm System panel.
- B. The Electrical Contractor shall provide an alarm output signal from the FAS panel to the BAS for unit shutdown.

### **2.3 ACTUATORS**

- A. Electronic actuators shall be sized to operate their appropriate dampers and valves with sufficient reserve power to provide smooth modulating action or two-position action as specified.
- B. Provide integral, auxiliary switches for direct coupled actuators to indicate when a desired position is reached or to interface additional controls for a specific sequence.
- C. Align actuator with drive shaft, provide permanent mark to identify closed position of end device.

### **2.4 SENSOR TRANSMITTERS**

- A. Duct and immersion sensors shall have minimum spans as required to meet the temperature requirements. Duct sensors shall have sensing elements of sufficient length and accuracy to measure average duct temperature in each location.
- B. Sensors shall be of corrosion resistant construction, tamperproof, suitable for mounting on a vibrating surface. Exposed capillaries shall be temperature compensated, and armored or installed in protective tubing.
- C. All sensing elements for water pipe mounting shall be of the rod and tube type with linear output and shall be furnished complete with separable protecting wells filled with heat conductive compound. Sensors shall be factory calibrated and tamperproof. If easily adjustable sensors are provided, they shall be located inside metal enclosures with cylinder lock and key to prevent unauthorized setting.
- D. Safety Devices: Provide the following:
  - 1. Low limit, electric type, with 20' long serpentine element, with manual reset, set for 37°F for "freeze" protection and 55°F for fan discharge application, unless otherwise noted.
  - 2. Air and water duty flow switches: Differential pressure type for fan and pump status.
  - 3. Carbon monoxide sensor/transducer/meter shall be analog type, requiring no field or periodic calibration, suitable for wall mounting.
    - a. Microprocessor controlled digital display of 0 to 250 ppm CO.
    - b. Analog output of 4 to 20 milliamps.
    - c. UL listed housing, suitable for an operating environment of 0 to 125 F/ 10 to 90% RH.
    - d. Repeatability of +/- 10% at 50 ppm; linearity of +/- 10%.

- e. Power input of 3.5 watts at 24 VAC.
  - f. Make: Macurco inc. model CM-2B.
  - g. Manufacturers: Air Test Technologies, Inc., Macurco, Rotronic Instrument Corp.,  
Vaisala, Inc.
4. Carbon dioxide sensor/transducer suitable for duct mounting.
- a. Analog output of 4 to 20 milliamps corresponding to 0 to 2000 ppm CO<sub>2</sub>.
  - b. ABS plastic housing, suitable for an operating environment of 0 to 125 F/ 0 to 100% RH, non-condensing.
  - c. Repeatability less than +/- 20 ppm.
  - d. Response time less than 60 seconds.
  - e. Power supply, 24 VAC.
  - f. Make: Vaisala Inc. model GMD 20 (duct)
  - g. Manufacturers: Air Test Technologies, Inc., Macurco, Rotronic Instrument Corp.,  
Vaisala, Inc.
5. Liquid Leak Detection System: Kele, Raychem, Trace Tek.
- a. Mechanical float devices attached to or inserted within the auxiliary pan are not acceptable.
  - b. Sensor shall be activated when there is at least ¼ inch of water, but no more than ½ inch of water in the auxiliary pan.
  - c. Equal to Kele Model WD-1B water detector.
    - (1) Weatherproof cast aluminum enclosure with adjustable mounting feet.
    - (2) 11-27VAC/VDC, 60 Hz, SPDT alarm contacts.
    - (3) LED indicators for power (green) and alarm (red).
    - (4) Fully adjustable detection level.

E. HUMIDITY TRANSMITTERS

1. Units shall be suitable for duct, wall (room) or outdoor mounting. Unit shall be two-wire transmitter utilizing bulk polymer resistance change or thin film capacitance change humidity sensor. Unit shall produce linear continuous output of 4-20 mA for percent relative humidity (%RH). A combination temperature and humidity sensor may be used for zone level monitoring. Sensors shall have the following minimum performance and application criteria:
- a. Input Range: 0 – 100% RH
  - b. Accuracy (%RH): +/- 2% (when used for enthalpy calculation, dewpoint calculation or humidifier control) or +/- 3% (monitoring only) between 20-90%RH at 77°F, including hysteresis, linearity, and repeatability.
  - c. Sensor Operating Range: As required by application.
  - d. Long Term Stability: Less than 1% drift per year.
2. Acceptable Manufacturers: Units shall be Vaisala HM Series, General Eastern, Microline, or Hy-Cal HT Series.

2.5 CONTROL VALVES

- A. Valves shall be rated for a minimum of 150 percent (150%) of system operating pressure at the valve location but not less than 125 psig.
- B. 2" and Smaller: Valves shall be bronze body with screwed or flared connections.

- C. 2-1/2" and Larger: Valves shall be bronze or iron body, flanged.
- D. Flow characteristics:
  - 1. Three-way valves shall have a linear relation of flow vs. valve position.
  - 2. Two-way valve position vs. flow relation shall be equal percentage for water flow control.
- E. Maximum pressure drop through valve:
  - 1. Modulating water flow control: 1/2 the pressure drop through the apparatus with maximum of 10 feet of water. Two position water valves shall be line size.
  - 2. Two-position steam control: 20 percent (20%) of inlet gauge pressure.
  - 3. Modulating steam control: 67 percent (67%) of inlet gauge pressure but not to exceed 45 percent (45%) of inlet absolute pressure (acoustic velocity limitation).

## 2.6 CONTROL DAMPERS

- A. The ATC Sub-contractor shall furnish all the controlled dampers of the type and sizes indicated on the drawings for installation by the sheet metal Sub-contractor.
- B. All 2-position control dampers shall be parallel blade and sized for minimum pressure drop, at the specified duct size.
- C. All modulating dampers shall be opposed blade and sized for an effective linear air flow control characteristics within the angle of rotation and maximum pressure drops specified. Information shall be provided to the sheet metal Subcontractor for determining the proper duct reductions or baffles used.
- D. Damper frames shall not be less than 16-gauge galvanized steel, formed with corner braces for extra strength, with mounting holes for enclosed duct mounting.
- E. All damper blades shall be of not less than 16-gauge galvanized steel formed for strength and high velocity performance. Blades on all dampers must not be over 8" in width. Blades shall be secured to 1/2" diameter zinc plated axles by zinc plated bolts and nuts. All blade bearings shall be nylon or oilite. Blade side edges shall be sealed off against spring stainless steel seals. Teflon coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blade leakage hardware shall be constructed of corrosion resistant, zinc plated steel and brass.
- F. Dampers shall be suitable for operation between -40 and 200 degrees. The control manufacturer shall submit leakage and flow characteristics plus a size schedule for all controlled dampers.
- G. All blade edges shall have inflatable seal edging that shall be rated for leakage less than 10 cubic feet per minute per square foot of damper area at a differential pressure of 4" of water when the damper is being held by a torque not to exceed 50 inert lbs. Leakage shall not exceed 1/2 of 1% of total flow.
- H. Provide permanent mark or scribe end of drive shaft to align damper with actuator in closed position.

## 2.7 CONTROL CABINETS

- A. Control cabinets shall be constructed of 18-gauge steel with locking hinged door. Unless otherwise specified, all controllers, electric relays, switches and other equipment furnished as part of the control system which are not required to be mounted on mechanical equipment, shall be cabinet mounted. The temperature indicators and switches shall be flush mounted on the door tagged with plastic labels. All electrical devices shall be wired to a numbered terminal strip and all devices shall be completely adjusted and checked for proper operation prior to shipment to job site. All wiring shall be numbered according to the control diagram.

## 2.8 SEQUENCE OF OPERATION

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION**

- A. Install system and materials in accordance with manufacturer's instructions and roughing-in drawings, and details and drawings. Install electrical work and use electrical products complying with requirements of these specifications. Mount controllers at convenient locations and heights.
- B. 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 wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. Low voltage wiring for space temperature sensors, communication bus between terminal units, etc., above accessible ceilings in finished spaces on the floors may be plenum rated cable. Wiring in all other locations shall be installed in EMT conduit. All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network (Ethernet, LonWorks, etc.) cabling shall be as tested and recommended in lieu of #18 gauge twisted, #22 or #24 gauge is acceptable if used as a part of an engineered structured cabling system. The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system.
- C. Provide all sensing, control, and interlock wiring for the following:
  - System inputs and outputs
  - System communications
  - System power
  - System interlocks
  - Unit controls
- D. The Control Manufacturer shall enter all computer data into the Host computer including all graphics, control programs, initial approved parameters and settings, and English descriptors. The Control Manufacturer shall maintain diskette copies of all data file and application software for reload use in the event of a system crash or memory failure. One copy shall be delivered to the owner during training sessions, and one copy shall be archived in the Control Manufacturer's local software vault.

#### **3.2 DATA CONTROL (D/C) AND GRAPHICS SUMMARY**

- A. All hardware, custom software, application software, graphics, etc., necessary to accomplish the control sequences and display the graphics specified shall be provided as part of this contract. Provide all controllers, inputs, outputs, valves, dampers, actuators and flow meters required to provide the control and graphic data described. Provide software setpoints required for display in logical groups and graphics.
- B. Each digital output shall have a software-associated monitored input. Any time the monitored input does not track its associated command output within a programmable time interval, a "command failed" alarm shall be reported.
- C. Where calculated points (such as CFM) are shown, they shall appear in their respective logical groups.
- D. Unless otherwise specified or approved prior to bidding, the primary analog input and the analog output of each DDC loop shall be resident in a single remote panel containing the DDC algorithm, and shall function independent of any primary or UC communication links. Secondary (reset type) analog inputs may be received from the primary network, but approved default values and/or procedures shall be substituted in the DDC algorithm for this secondary input if network communications fail or if the secondary input becomes erroneous or invalid.

### 3.3 ACCEPTANCE

- A. The Control Manufacturer shall completely check out, calibrate and test all connected hardware and software to ensure that the system performs in accordance with the approved specifications and sequences of operations approved.
- B. Witnessed acceptance demonstration shall display and demonstrate each type of data entry to show site specific customizing capability; demonstrate parameter changes; execute digital and analog commands; and demonstrate DDC loop stability via trend of inputs and outputs.

### 3.4 MANUALS

- A. The following manuals will be provided:
  - 1. An Operators Manual shall be provided with graphic explanations of keyboard use for all operator functions specified under Operator Training.
- B. Computerized printouts of all GPC data file including all point processing assignments, physical terminal relationships, scales and offsets, command and alarm limits, etc.
- C. A manual shall be provided including revised as-built documents of all materials required under the paragraph "SUBMITTALS" on this specification.
- D. Two Operators Manuals, and two As-Built Manuals shall be provided to the owner.

### 3.5 TRAINING

- A. All training shall be by the BMCS contractor and shall utilize operators manuals and as-built documentation.
- B. Operator training shall include three (3) four-hour sessions encompassing modifying text and graphics, sequence of operation review, selection of all displays and reports, use of all specified OWS functions, troubleshooting of sensors (determining bad sensors), and password assignment and modification. One training session shall be conducted at system completion, one shall be conducted forty five days after system completion, and one at ninety (90) days, or as requested by the Owner.

### 3.6 SERVICE GUARANTEE

- A. The control system herein specified shall be free from defects in workmanship and material under normal use and service. After completion of the installation, the control manufacturer shall regulate and adjust all thermostats, control valves, motors and other equipment provided under this contract. If within twelve (12) months from date of acceptance either for beneficial use of final acceptance, whichever is earlier, any of the equipment herein described is proven to be defective in workmanship or materials, it will be replaced or repaired free of charge. The control manufacturer shall, after acceptance, provide any service incidental to the proper performance of the control system under guarantee outlined above for the period of one year. Normal maintenance of the system or adjustments of components is not to be considered part of the guarantee. The control manufacturer will upon completion of the installation, during the warranty period, make available to the Owner, an annual service agreement covering all labor and material required to efficiently maintain the control system.

### 3.7 FINAL ADJUSTMENT

- A. After completion of installation, adjust thermostats, control valves, motors and similar equipment provided as work of this section.
- B. Final adjustment shall be performed by specially trained personnel in direct employ of installer of primary temperature control system.

END OF SECTION 23 0900



## SECTION 23 0950

### TESTING & BALANCING OF MECHANICAL SYSTEMS

#### PART 1 – GENERAL

##### 1.1 JOB CONDITIONS

- A. Systems shall be completely installed and in continuous operation as required to accomplish the tests.
- B. Heating, ventilating and air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the balance work specified.
- C. Adjust and balance shall be performed when outside conditions approximate design conditions indicated for heating and cooling functions.
- D. Make at least two inspections of the mechanical systems during construction to verify that balancing procedures may be accomplished. Report findings to the Architect/Engineer/Construction Manager.
- E. Balancing firm shall balance Mechanical System two (2) times. The first time shall be considered a rough balance. Any discrepancy in air flow shall be addressed to the Architect/Engineer/Construction Manager. The final balancing will be accomplished after review of rough balance reports.
- F. The final balancing reports shall be submitted and approved prior to project's being considered complete; i.e., commencement of warranties.

##### 1.2 ENGINEER QUALIFICATIONS

- A. The firm shall be an independent organization having no affiliation with construction contractors, equipment sales or design engineering.
- B. The firm shall specialize in balancing heating, ventilating and air conditioning systems.
- C. The firm shall show proof of having balanced and tested at least five projects of similar size and scope.
- D. All field work shall be under the direct supervision of a registered Professional Engineer who is a full-time employee of the balancing firm.
- E. The firm shall be certified by and a member of the AABC (Associated Air Balance Council), or NEBB (National Environmental Balancing Bureau).

##### 1.3 REPORT

- A. Data Sheets:
  - 1. Submit data sheets on each item of testing equipment required.
  - 2. Include name of device, manufacturer's name, model number, latest date of calibration and correction factors.
- B. Report Forms:
  - 1. Submit specimen copies of report forms.
  - 2. Forms shall be 8-1/2 x 11 inch paper for loose-leaf binding, with blanks for listing of the required test ratings and for certification of report.
  - 3. Reports shall be on standard forms published by AABC or NEBB.

#### PART 2 – PRODUCTS

##### 2.1 AIR BALANCE INSTRUMENTS

- A. Alnor Velometer with probes and alnor pitot tube.
- B. Rotating Vane Anemometer: 4 inch size.
- C. ASHRAE Standard Pitot Tubes, stainless steel 5/16 inch outside diameter, lengths 18 inches and 36 inches.

- D. Magnehelic Differential Air Pressure Gauges, 0 to 0.5 inches, 0 to 1.0 inch and 0 to 5.0 inches water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.
  - E. Combination Inclined-Vertical Portable Manometer, range 0 to 5.0 inches water.
- 2.2 WATER BALANCING INSTRUMENTS
- A. 30 Inch Mercury U-Tube Manometer, 200 psig, with 3 valve bypass assembly and return wells or mercury check valves.
  - B. Inspector's gauge testing set.
  - C. Water Differential Pressure Gauge, 4-1/2 inch dial, 0 to 100 psi range.
  - D. Pressure gauge measurement points, quick connect couplings, 1/4 inch psi.
- 2.3 SYSTEM PERFORMANCE MEASURING INSTRUMENTS
- A. Insertion Thermometers, with graduation at 0.5 degrees F for air and 0.1 degrees F for water.
  - B. Sling Psychrometer.

### **PART 3 – EXECUTION**

#### 3.1 GENERAL REQUIREMENTS

- A. Arrange and pay for all tests.
- B. Notify Architect/Engineer/Construction Manager at least three working days in advance of test and conduct in presence of Architect/Engineer/Construction Manager.
- C. Tests to be performed prior to insulation, covering or concealment.
- D. Provide signed report of completion of test with signature of witnesses. Report shall indicate:
  - 1. System Tested
  - 2. Date
  - 3. Specified test requirements and actual testing results
- E. The balancing firm shall report to and review the work required with the Architect/Engineer before beginning field balance work. The balancing firm shall make at least two inspections of the air systems during construction and shall report his findings in writing to the Architect/Engineer.
- F. The balancing firm shall cooperate with the Architect/Engineer/Construction Manager and the Mechanical Contractor to effect smooth coordination of the balancing work with the job schedule.
- G. The balancing firm shall be responsible for getting the various systems into proper operation. They shall enlist the aid of the equipment suppliers and Mechanical Contractor as may be required to effect proper operation consistent with the contract plans and specifications.
- H. When the balancing firm cannot balance a belt-driven piece of equipment with the supplied belts and sheaves, inform the Mechanical Contractor that the Mechanical Contractor shall provide additional sheaves as spelled out in other Division 23 Sections.

#### 3.2 DUCTWORK TESTING

- A. Witness testing conducted by the Mechanical Contractor per Section 230600, PART 3: EXECUTION.

#### 3.3 BALANCING PROCEDURE

- A. Air System Balance:
  - 1. With the fan supply system set to handle normal minimum outdoor air, the balancing firm shall perform the following tests and compile the following information:
    - Air Handling Equipment
      - a. Design Conditions:

- (1) CFM Supply Air
    - (2) Static Pressure
    - (3) CFM Fresh Air
    - (4) Fan RPM
  - b. Installed Equipment:
    - (1) Manufacturer
    - (2) Size/Model Number
    - (3) Motor HP, Voltage, Phase, Full Load Amperes
  - c. Field Test:
    - (1) Fan Speed
    - (2) No Load Operating Amperes
    - (3) Fan Motor Operating Amperes
    - (4) Calculated BHP
  - d. Test for Total Air:
    - (1) Size of discharge, return air and outside air ducts.
    - (2) Number and locations of Velocity Readings taken.
    - (3) Duct Average Velocity
    - (4) Total CFM
    - (5) Outside Air CFM
    - (6) Return Air CFM
  - e. Individual Outlets (Diffusers, Registers and/or Grilles):
    - (1) Identify each outlet or inlet as to location and area and fan system
    - (2) Outlet, manufacture and type
    - (3) Outlet size
    - (4) Outlet free area, core area, or neck area
    - (5) Required FPM and test velocity found for each outlet.
    - (6) Required CFM and test results for each outlet
  2. After completion of tests, adjustment and balancing under minimum fresh air conditions, set the system for 100% fresh air. Repeat the total CFM tests to check field versus design conditions. The results under 100% fresh air cycle shall agree with conditions found under "minimum fresh air operation" before the system is considered to be in balance. Adjustments of the proper dampers shall be made to achieve balance.
  3. Testing and adjusting of individual outlets shall be performed under procedures recommended by the manufacturers of the outlets. All outlets shall be set for air pattern required and all main supply air and return air dampers to be adjusted and set for design CFM indicated. Any required changes in air patterns, settings, etc., necessary for achieving correct air balance, shall be provided by this Contractor. Total CFM of all outlets shall agree with total CFM of all branches and the grand total shall agree with the air volume for the fan(s).
- B. Water Balance:
1. Water balance shall include heating water, chilled water systems. The balancing agency shall perform the following tests, compile data and submit reports.

2. Heating and/or Cooling Elements Including Loop Water to all terminal Units:
  - a. Design Data:
    - (1) MBH Specified, GPM Specified
    - (2) Entering Water Temperature (EWT)
    - (3) Entering Air Temperature (EAT)
    - (4) Water Temperature Drop (DTW)
    - (5) Element Type Specified
  - b. Field Test:
    - (1) Identify each element as to location
    - (2) Required water temperature drop corrected for item (3) above
    - (3) Actual entering air and water conditions (temperature and GPM)
    - (4) Adjust element until required temperature drop is obtained
- C. In addition to the above work, the Balancing Firm shall check the operation of all automatic temperature control equipment; verify all thermostat, aquastat, etc., set-points and operations; and enlist the aid of the Mechanical Contractor and the Control Subcontractor to make necessary adjustments where required.

END OF SECTION 23 0950

**SECTION 26 0000**  
**GENERAL PROVISIONS – ELECTRICAL**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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 of this Section.
- B. The specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.

1.2 DESCRIPTION OF WORK

- A. Provide all materials, equipment, labor, services and all appurtenances required to completely install and satisfactorily operate the various systems. The items listed below are for general guidance only and do not necessarily include the entire requirements for the project.

- 1. Coordination with other trades
- 2. Interior feeders
- 3. Lighting and power panels
- 4. Lighting branch wiring
- 5. Power wiring
- 6. Lighting fixtures and lamps
- 7. Wiring devices
- 8. Connections for electrically operated equipment
- 9. Fire alarm and detection system modifications
- 10. Telephone/Data raceway system
- 11. Related work as herein described or otherwise defined under the heading "Related Work".

- B. Wherever the term "provide" is used, it shall be understood to mean both "furnish" and "install".

1.3 RELATED WORK

- A. Equipment specified in sections of Divisions 1 thru 23 that require electric power supply.
- B. Work related to this trade as defined on the following contract drawings:

Architectural/Structural  
HVAC  
Plumbing

1.4 SITE CONDITIONS

- A. Attention of all bidders is called to the necessity for a careful inspection of the site, its present condition and encumbrances, the extent of the work, the protection to be afforded to adjacent properties or structure, availability of utilities, the extent and nature of the material required to be excavated and the amount of fill and removal. He shall also determine local or site limitations which will affect construction.

1.5 PERMITS, INSPECTIONS AND ORDINANCES

- A. All work shall be executed and inspected in accordance with local and state ordinances, rules and regulations and the requirements of public utilities having jurisdiction. The contractor shall secure and pay for all permits, inspections and connections required.

- B. The Electrical Contractor shall furnish a certificate of inspection to the Owner at the time of completion.
  - C. Requirements of the following organization shall be considered minimum:
    - 1. National Electrical Code
    - 2. National Electrical Safety Code
    - 3. OSHA
    - 4. Local City and County Codes
  - D. Reference to technical societies, trade organizations and governmental agencies are in accordance with the following:
    - 1. ANSI - American National Standards Institute
    - 2. ASTM - American Society for Testing Materials
    - 3. IEEE - Institute of Electrical and Electronics Engineers, Inc.
    - 4. NEC - National Electrical Code
    - 5. NEMA - National Electrical Manufacturer's Association
    - 6. NFPA - National Fire Protection Association
    - 7. MSS - Manufacturer's Standardization Society
    - 8. IES - Illuminating Engineers Society
    - 9. ETL - Engineering Testing Laboratories
    - 10. EIA - Electronic Industries Association
    - 11. OSHA - Occupational Safety and Health Administration
    - 12. Federal Specifications
    - 13. UL - Underwriters Laboratories, Inc.
- 1.6 QUALITY ASSURANCE
- A. Provide adequate supervision of labor force to assure that all aspects of the contract documents are fulfilled.
  - B. Contractor to provide manufacturer's written certification that the following equipment has been installed and will operate correctly and in accordance with the manufacturer's warranty requirements.  
Fire Alarm and Detection System
  - C. Testing:
    - 1. After completion of the work, the entire wiring system shall test entirely free from grounds, short circuits, opens, overloads and improper voltage.
    - 2. The grounding system shall be tested for a resistance of 25 ohms or less.
    - 3. Perform testing as follows: Arrange and pay for all tests, provide all equipment, materials and labor to perform test. Notify Engineer and Owner three (3) working days before tests are to be made. Conduct tests in the presence of the Engineer or authorized representative. Repeat tests after defects are corrected.
  - D. Special Engineering Services: In the instance of complex specialized electrical power and signaling systems, and other similar systems, the installation and final connections of these systems shall be made by and/or under the supervision of a competent installation and service engineer who shall be a representative of the respective equipment manufacturer. Any and all expenses of these installation and service engineers shall be borne by this Contractor.

## 1.7 COORDINATION

- A. As a requirement of this project, the Electrical Contractor shall furnish coordination for his equipment and layouts with other subcontractors furnishing equipment and services for Divisions 1 thru 23. Any and all contractors who install their equipment or furnish services prior to coordination, any contractor who changes their equipment or services after coordination has occurred, without notifying associated subcontractors, shall be held responsible for making all required changes with no additional cost to the Owner. Or delay in construction time. This coordination will include conduit layout to allow access to equipment for maintenance.
- B. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed.
- C. The drawings and specifications reflect the type, number and size of services required for the equipment the design is based upon. Should the supplying subcontractor elect to furnish an alternate piece of equipment requiring difference services and/or space conditions, he shall inform the subcontractor furnishing those services and be held responsible to pay for all required changes as part of this contract.

## 1.8 SUBMITTALS

### A. Shop Drawings:

- 1. Shop drawings shall be submitted in accordance with Division 1 of these specifications except where herein modified.

**NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.**

- 2. Shop drawings comprising complete catalog cuts, performance test data for electrical equipment as required by other sections of Division 26 shall be submitted for review checking. The Contractor shall review these shop drawings for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, wiring diagrams and similar materials, the Electrical Contractor represents that he and/or his subcontractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the Divisions 1 thru 23 subcontractors.
- 3. All shop drawing submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto:
  - a. Project name
  - b. Project number
  - c. Sub-Contractor's, Vendor's and/or manufacturer's name and address.
  - d. Product identification.
  - e. Identification of deviation from the contract documents.
  - f. Applicable contract drawings and specification section number.
  - g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
  - h. Resubmit revised or additional shop drawings as requested.
  - i. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the Contractor making the submission to identify by name, the Contractor who is to do this work. If the Contractor named is other than the Contractor making the submission, the shop drawing submission must be reviewed by the

named Contractor and bear his mark of approval, prior to submission to the Architect/Engineer.

- j. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.
- k. The Contractor shall keep one copy of approved shop drawings at the job site, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.
- l. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.

#### 1.9 SUBSTITUTIONS

- A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.
- B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the contractor or an equipment vendor to deviate from the written portion of the specifications unless so stated in the addendum.
- C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.
- D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, then they shall be responsible for any and all additional costs associated with the changes required by other trades.

#### 1.10 LUBRICATION

- A. Furnish, install and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.
- B. Provide one year's supply of lubricants to Owner at date of acceptance.
- C. Verify that required lubrication has taken place prior to any equipment start-up.

#### 1.11 ADJUSTMENT & CLEANING

- A. Adjust and clean equipment to be placed in proper operation condition.

#### 1.12 EQUIPMENT START-UP

- A. Verify proper installation by manufacturer or his representative.
- B. Advise General Contractor 2 days prior to actual start-up.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.

#### 1.13 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.
- B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.

- C. Such instruction shall be for each item of equipment and each system as a whole.
  - D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.
  - E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
  - F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.
  - G. Training
    - 1. Electrical Contractor shall be responsible for coordination of Owner training. Factory employed technician(s) shall provide training, including demonstration and education on the system capabilities, operation and maintenance. Training sessions shall be minimum 4 hours (maximum 8 hours), and shall be provided for each shift of workers. Scheduled training shall be coordinated at least two 92) weeks in advance with the Owner and the Commissioning Agent.
- 1.14 TOOLS
- A. All equipment furnished by the Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.
- 1.15 CLEANING AND FINISHING
- A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.
- 1.16 OPERATING AND MAINTENANCE MANUALS
- A. Three complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished to the Architect. Each set shall be furnished before the contract is completed. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", the name and location of the building, the name of the Contractor and the name of the Architect and Engineer. Flysheet shall be placed before instructions covering each subject. The instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. The instructions shall include, but shall not be limited to, the following:
    - Approved wiring and control diagrams, with data to explain the detailed operation and control of each component.
    - A control sequence describing start-up, operation and shutdown.
    - Operating and maintenance instructions for each piece of equipment, including lubrication instructions.
    - Manufacturer's bulletins, cuts and descriptive data.
    - Parts lists and recommended spare parts.
- 1.17 SERVICE INTERRUPTION
- A. All service interruptions to the electric or related systems, whether during regular working hours or at

any other time, must be coordinated with the Owner. All such interruptions shall be so scheduled and planned as to require a minimum of time and shall occur only during a mutually satisfactory period.

#### 1.18 INTERPRETATION OF SYSTEMS

- A. The interpretation of the Architect will be final in the event there is a lack of understanding of the full scope or requirements of the systems under this contract.

#### 1.19 LAYOUTS

- A. On small scale drawings, i.e., 1/8" - 1'-0", the approximate location of the electrical branch circuit items such as receptacle, telephone, grounding and equipment outlets are shown to indicate their existence. The exact location of these items and their related raceways are governed by structural conditions, coordination with the work of other trades and the Architect's final decision. By accepting a contract, the Contractor agrees to install the work in accordance with the above statement and within the contract price.

### **PART 2 – PRODUCTS**

#### 2.1 MATERIAL

- A. All material shall be new and of good quality. Material shall conform to all accepted trade standards, codes, ordinances, regulations, or requirements governing same, and shall be approved before being installed.
- B. The Architect reserves the right to require the Contractors to submit samples of any or all articles or materials to be used on the project.
- C. Where any device or equipment is herein referred to in the singular number, such as "the panel", this reference shall be deemed to apply to as many such devices or equipment as are required to complete the installation as shown on the drawings or specified.
- D. All materials and equipment used in the work shall comply with the standards of recognized authorities such as UL, NEMA, IEEE, ETL, IES and EIA in every instance where such standards have been established for the particular type of materials to be installed.
- E. All similar pieces of equipment or materials of the same type or classification used for the same purpose shall be of the same manufacturer.
- F. All manufactured equipment shall have factory applied finishes.

#### 2.2 CONCRETE

- A. Concrete shall be in accordance with Section 03300, or ACI-613. Designer choice if 03300 is not used.
- B. The 28-day minimum compressive strength shall be 3000 psi.

#### 2.3 WARRANTY

- A. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the contract documents.

### **PART 3 – EXECUTION**

#### 3.1 INSPECTION

- A. Prior to performing the work, examine areas and conditions; check and verify all dimensions, under which the work is to be installed and notify the Architect in writing of conditions and dimensions detrimental to the proper and timely completion of the work. Do not proceed until authorization is given by the Architect.

### 3.2 LAYING OUT WORK

- A. The Contractor is responsible for the accuracy of all lines, elevations, and measurements, grading and utilities and must exercise proper precaution to verify figures shown on drawings before laying out work and will be held responsible for any error resulting from his failure to exercise such precaution.

### 3.3 WORKMANSHIP

- A. Install all work neat, trim, parallel and plumb with building lines in accordance with standard trade practice acceptable to the Architect.

### 3.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect all equipment and materials from damage during transportation, storage and installation.

### 3.5 PROTECTION

- A. Protect all work, equipment and materials during construction up to the time of acceptance by the Owner.

Arrange and design the protection to prevent damage from infiltration or dust, debris, moisture, chemicals and water. Cap or plug electrical raceways.

- B. Protect all surfaces against damage from welding, cutting, burning, or similar construction functions. This protection shall be accomplished by care in operations, covering and shielding. Special care is directed to exposed finished masonry, metal or wood surfaces and painted surfaces. Corrective measures required shall be accomplished by the trade which made the original installation when and as directed by the Architect at the expense of the Contractor.
- C. Cover and protect all lighting fixtures as may be necessary until completion of the work. Replace damaged fixtures or damaged fixture parts as directed by the Architect at no cost to the Owner.
- D. Do not install devices, polished metal fittings or parts until adjoining tile or masonry work is completed.
- E. Maintain and replace protective covering when so directed by the Architect until the work is ready for acceptance.

### 3.6 CUTTING & PATCHING

- A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panel boxes and other equipment or devices. If the information is late or incorrect, this Contractor shall, at his own expense, have the trade which originally installed the work do the required cutting and patching.
- B. Perform all cutting of concrete or other material for passage of raceways as required to install the work.
- C. Close all such openings around raceways with material as specified under the heading "SEALING".
- D. Install concealed work in place for the mason to wall-in as he carries up the walls; otherwise, this Contractor will be responsible as stated in the first paragraph.

### 3.7 SEALING

- A. Where raceways pass through fire-rated walls and floors, seal opening with RTV foam.
- B. Seal raceways entering the building to conform to the requirements of the NEC.

### 3.8 OFFSETS AND MODIFICATIONS

- A. Furnish and install all offsets necessary to install the work and to provide clearance for the work of other trades.
- B. Maintain adequate clearance as directed by the Architect/Engineer.
- C. Incidental modifications necessary to the installation shall be made as necessary and at the direction and/or approval of the Architect.

### 3.9 SLEEVES

- A. Furnish and install sleeves for all raceways passing through floors and walls. Sleeves shall be Schedule 40 galvanized steel pipe and shall extend 1" above finished floor surface. Where sleeves are set in interior walls, they shall finish flush with the wall.
- B. Furnish and install watertight sleeves for all raceways extending through foundation walls into crawl spaces, mechanical rooms or basement areas from building exterior or from unexcavated areas to building interior. Sleeve shall consist of extra heavy pipe sleeve with anchor flange. Space between raceway and the sleeve shall be sealed with modular wall and casing seal similar to Thunderline Corporation "Link-Seal", Metraseal or approved substitute. Install seal in strict accordance with the manufacturer's recommendations.

### 3.10 FOUNDATIONS FOR EQUIPMENT/HOUSEKEEPING PADS

- A. Provide all foundations for equipment installed under this specification Division and/or as indicated on plans.
- B. Construct concrete foundations on structural floor slabs or on grade in the manner or as required by the approved shop drawing details of the manufacturer or the utility company.
- C. Provide and install concrete.
- D. Metal reinforcement shall be deformed steel bars or cold drawn steel wire, or fabricated forms of these materials as required.
- E. Furnish anchors of size and number noted, with bottom plates and sleeves.
- F. Forms shall conform to the shape, lines, grades, and dimensions of the concrete, required by the approved shop drawing details of the equipment manufacturers, or approved on the Contractor's Equipment room layouts. They shall be sufficiently tight to prevent leakage of mortar and shall be braced or tied together to maintain position and shape. Forms shall be moved in such manner as to insure the complete safety of the structure.
- G. All exposed corners or edges shall be chamfered. All burrs, fins, irregularities of forming or spillage shall be removed and the surface float or trowel finished to a smooth, straight surface.
- H. Housekeeping Pads: Provide 4" thick, and size as required by approved shop drawings, concrete pad for all equipment installed on floor. Pad shall be steel reinforced with all edges and surfaces finished as described above. When installing over existing concrete, surface of existing pad shall be prepped using a bushing tool to rough in entire surface. Whether pouring over new or existing concrete, provide U-shaped rebar anchors set in epoxy to secure pad to pad.

### 3.11 ITEMS RECESSED IN MASONRY CONSTRUCTION

- A. Wherever boxes, electric panels, equipment, devices, access panels, and similar items of electrical construction are installed in exposed masonry construction, the Contractor shall utilize and submit for approval items of such size, height, and arrangement to conform to the corresponding masonry unit. The Contractor shall include as part of this contract, the necessary offsets, adjustments and relocations necessary to conform with the instructions of the Architect as to the final location of the equipment item in the exposed masonry.
- B. As part of his contract and before the purchase of the items hereinbefore mentioned, the Contractor shall notify the Architect of such modifications in the building arrangement that will be necessary to accommodate the proposed equipment.

### 3.12 ROOF FLASHINGS

- A. All conduit extending through roofs shall be provided with watertight flashing and counterflashing as hereinafter described.

- B. Furnish and install standard counterflashing fittings on the conduit or properly designed clamped counterflashing with caulking as directed by the Architect/Engineer.

3.13 PAINTING

- A. Refinish all factory applied finishes that have been damaged to match the original finish as directed by the Architect.
- B. Prime coat all steel furnished under this Division with material and methods as described in another Section under the heading "PAINTING".

3.14 EQUIPMENT CONNECTIONS

- A. Provide required wiring, raceways and final connections for all equipment provided by this Division and Divisions 1 thru 23.
- B. Make final connections in accordance with wiring diagrams obtained from equipment manufacturer.
- C. Rough-in in accordance with approved shop drawings from the manufacturer or supplier of the equipment. Rough-in prior to shop drawing approval will be subject to change without adjustment to contract cost.

3.15 BALANCING

- A. The system of feeder and branch circuits for power and lighting shall be connected to panel busses in such a manner as to electrically balance the connected load as close as is practicable. Should the Owner disclose any unfavorable conditions reacting on the service, this Contractor shall make such changes as may be suggested to balance the load.

3.16 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the Owner unless otherwise specified in Division 1.
- B. Guarantee shall be extended on an equal time basis for all non- operational periods due to failure within the guarantee period.
- C. Contractor to include an 11 month "walk-thru" of the building system with representatives of the School District, Architect, Engineer and the Construction Manager. The purpose is to establish a list of corrective work that relates to operational issues, material/installation deficiencies.

END OF SECTION 26 0000



**SECTION 26 0055**  
**ELECTRICAL IDENTIFICATION**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. This section is a Division 26 Basic Materials and Methods Section, and is part of each Division 26 Section making reference to electrical identification specified herein.

1.2 DESCRIPTION OF WORK

- A. Types of electrical identification specified in this section include the following:
  - Cable conductor identification.
  - Operational instructions and warnings.
  - Danger signs.
  - Equipment/system identification signs.

**PART 2 – PRODUCTS**

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following (for each type of marker):
  - W. H. Brady Co.
  - Ideal Industries, Inc.
  - Seton Name Plate Co.
  - 3M Electrical Products

2.2 ELECTRICAL IDENTIFICATION MATERIALS

- A. Provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

2.3 COLOR-CODED PLASTIC TAPE

- A. Provide manufacturer's standard vinyl tape not less than 7 mils thick by 3/4" wide.
- B. Colors: Unless otherwise indicated or required by governing regulations, provide tape color as indicated in Paragraph 3.2.B.
- C. Tape shall be of Type 3M Scotch 35 for color coding, Scotch Super 33+ for splices and Tem Flex 1700 for general use.

2.4 CABLE/CONDUCTOR IDENTIFICATION BANDS

- A. Provide manufacturer's standard vinyl cloth, self-adhesive cable/conductor markers of wrap-around type; either pre-numbered, plastic-coated type, or write-on type with clear plastic, self-adhesive cover flap; numbered to show circuit identification.

2.5 BAKED ENAMEL DANGER SIGNS

- A. Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gage steel; of standard red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording (as examples: HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH).

## 2.6 ENGRAVED PLASTIC-LAMINATE SIGNS

- A. Provide engraved stock melamine plastic laminate, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

## 2.7 LETTERING AND GRAPHICS

- A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.

# PART 3 – EXECUTION

## 3.1 APPLICATION AND INSTALLATION

- A. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
- B. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

## 3.2 CABLE/CONDUCTOR IDENTIFICATION

- A. Apply cable/conductor identification on each cable and conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project electrical work.
- B. Conductor Color Coding:
  - 1. All conductors used in all systems shall have insulation that is inherently colored. All conductors of a system performing the same function shall be colored alike throughout the project.
  - 2. Equipment Grounding Conductors:
    - a. Standard and/or general feeders or circuits shall be green.
    - b. Isolated feeders or circuits shall be green with yellow stripe.
  - 3. On larger conductors, where colored insulation is not available, colored tape adhesive vinyl bands 3/4" width may be installed 6" maximum from the end of the conductors. Where passing through pull boxes without splice, each conductor shall be banded.
  - 4. Power system conductor colors shall be as follows:
    - a. 120/208 Volt System
      - Phase A - Black
      - Phase B - Red
      - Phase C - Blue
      - Neutral - White or Gray
    - b. 277/480 Volt System
      - Phase A - Brown
      - Phase B - Orange
      - Phase C - Yellow

Neutral - White or Gray

### 3.3 DANGER SIGNS

- A. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.
- B. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power voltages higher than 110-120 volts.

### 3.4 EQUIPMENT/SYSTEM IDENTIFICATION

- A. Install engraved, plastic laminate sign on each major unit of electrical equipment in building, including central or master unit of each electrical system including communication/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawing. Provide signs for each unit of the following categories of electrical work:
  - 1. Panelboards, electrical cabinets and enclosures.
  - 2. Access panel/doors to electrical facilities.
  - 3. Major electrical switchgear, main and feeder circuit breakers and/or disconnects..
- B. Install signs at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.

### 3.5 JUNCTION AND PULL BOX IDENTIFICATION

- A. Emergency Systems: Each junction and pull box cover shall be painted orange. Use black indelible liquid marker to label "EMERG." in 3/8" letters minimum.
- B. Fire Alarm System: Each junction and pull box cover shall be painted red. Use black indelible liquid marker to label "F.A." in 3/8" letters minimum.
- C. Feeders Shown on Single Line Diagram: Each junction and pull box shall be marked with black indelible liquid marker with the assigned feeder number "FDR #38" in 3/8" letters minimum.

END OF SECTION 26 0055



**SECTION 26 0110**  
**RACEWAYS**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. 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.
- B. Refer to Section 260000 for General Provisions - Electrical.

1.2 DESCRIPTION OF WORK

- A. Types of raceways in this section include the following:
  - Rigid metal conduit
  - Intermediate metal conduit
  - Electrical metallic tubing.
  - Polyvinyl chloride conduit (Exterior Underground Only)
  - Flexible metal conduit.
  - Liquid-tight flexible metal conduit.
  - Surface raceway.
  - Wireways.

1.3 REFERENCE STANDARDS

- A. Refer to Section 260000 for a general description of requirements applying to this Section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 260000 for a general description of requirements applying to this Section.

1.5 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

1.6 COORDINATION

- A. The drawings and details there upon are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all raceways, raceway supports, junction boxes and required fittings. This coordination will include conduit layout to allow access to equipment for maintenance.
- B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.
- C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

**PART 2 – PRODUCTS**

2.1 MATERIALS AND EQUIPMENT

- A. Rigid Metal Conduit:
  - 1. Raceway: Full weight, heavy wall rigid steel with zinc coating conforming to ANSI-C80.1.

2. Fittings: Cast malleable iron fittings with threaded hubs, insulated throat and zinc protective coating.
  3. Subject to compliance with requirements, provide products of one of the following:  
Allied Tube and Conduit Corporation  
LTV Steel Tubular Products Co.  
Wheatland Tube
- B. Intermediate Metal Conduit:
1. Raceway: Light weight, rigid steel, hot dipped galvanized manufactured in accordance with UL1242.
  2. Fittings: Cast malleable iron fittings with threaded hubs, insulated throat and zinc protective coating.
  3. Subject to compliance with requirements, provide products of one of the following:  
Allied Tube and Conduit Corporation  
LTV Steel Tubular Products Co.  
Wheatland Tube
- C. Electrical Metallic Tubing:
1. Raceway: Light weight, thin wall, rigid steel, hot dipped galvanized manufactured in accordance with ANSI C80.3.
  2. Fittings: Raintight, insulated throat, compression type with zinc protective coating.
  3. Subject to compliance with requirements, provide products of one of the following:  
Allied Tube and Conduit Corp.  
LTV Steel Tubular Products Co.  
Wheatland Tube Co.
- D. Polyvinyl Chloride Conduit:
1. Raceway: Heavy wall, rigid non-metallic, schedule 40 with bell type end, designed for above ground exposed applications, direct earth burial, and concrete encasement.
  2. Fittings: Polyvinyl chloride, heavy duty, glue type, designed for Schedule 40 application.
  3. Subject to compliance with requirements, provide products of one of the following:  
Allied Tube & Conduit  
Carlton  
Queen City Plastics, Inc.  
Scepter Electric Systems
- E. Flexible Metal Conduit:
1. Raceway: Construct of single strip, flexible, continuous, interlocked, and double-wrapped steel, galvanized inside and outside.
  2. Fittings: Steel, insulated throat, with zinc protective coating.
  3. Subject to compliance with requirements, provide products of one of the following:  
AFC  
Alflex Corp.  
Electri-Flex Company

F. Liquid-Tight Flexible Metal Conduit:

1. Raceway: Construct of single strip, flexible, continuous, interlocked, and double-wrapped, galvanized inside and outside, coat with liquid-tight jacket of flexible polyvinyl chloride.
2. Fittings: Steel, water and oiltight, insulated throat, with zinc protective coating.
3. Subject to compliance with requirements, provide products of one of the following:  
AFC  
Alflex Corp.  
Electri-Flex Company

G. Wireways:

1. Furnish electrical wireways of the type, size, and style for each service indicated. Wireway shall be a complete assembly including but not necessarily limited to, couplings, offsets, elbows, adapters, hold-down clips, end-caps and other components and accessories as needed for a complete system.
2. System shall fulfill wiring requirements as indicated in contract documents, and shall comply with applicable portions of Article 362 of the National Electrical Code.
3. Subject to compliance with requirements, provide products of one of the following:  
Circle AW Products Co.  
The EMF Company, Inc.  
Hoffman Engineering Company  
Square "D" Company

- H. The above items shall include the statement "Approved Equal" and/or "Approved Substitute". This statement requires that the product or item be in compliance with the written intent of this specification and the submission meets the requirements of Section 260000.

**PART 3 – EXECUTION**

3.1 INSTALLATION OF ELECTRICAL RACEWAYS

- A. Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.
- B. Coordinate with other work as necessary to interface installation of electrical raceways, wireways and required components.
- C. Raceways used for distribution, feeders, or branch circuits shall be a minimum size of 3/4" or equal equivalent cross-sectional area. Raceways used for control and signal shall be a minimum size of 1/2" or equal equivalent cross-sectional area.
- D. All raceways shall be concealed within the building construction, where indicated on the floor plans surface raceway shall be installed. Should it be impossible or impracticable to install a raceway concealed and surface raceway is not indicated, the Contractor shall consult with the Architect or Engineer for approval prior to installation.
- E. All raceways installed in ceiling cavities and exposed within mechanical spaces shall be run parallel with building lines and installed level and square at the proper elevation/height.
- F. Complete the installation of electrical raceways before starting the installation of cables/wires within the raceway.
- G. Furnish and install one (1) nylon or fiberglass pull cord in each empty raceway. Each empty raceway shall be cleaned, capped, and tagged as to its termination location.

- H. Install liquid-tight flexible metal conduit for connections to motors and for other electrical equipment when subject to movement and vibration, and also where subjected to one or more of the following conditions:
    - 1. Exterior locations.
    - 2. Moist or humid atmosphere when condensation can be expected to accumulate.
    - 3. Corrosive atmosphere.
    - 4. Subjected to water spray.
    - 5. Subjected to dripping oil, grease or water.
  - I. Install Electrical Metallic Tubing for building interior electrical work except:
    - 1. Underground
    - 2. In gravel, cinder, concrete or other sub-base floor construction.
    - 3. Horizontal runs in concrete floor slabs.
    - 4. Where exposed to the elements.
    - 5. In masonry construction below finished grade.
    - 6. Vertically in poured concrete walls.
  - J. Refer to Section 260000 for excavation, shoring and pumping, concrete and backfilling requirements.
  - K. Where and whenever possible, install horizontal electrical raceways as tight to building construction as possible and above water, drain and steam piping. A separation of at least six (6) inches shall be maintained between electrical conduits and hot water and steam piping.
  - L. In accordance with NEC requirements, install Rigid or Intermediate Metal Conduit where Electrical Metallic Tubing is not permitted.
  - M. In all instances where recessed type panelboards are installed, furnish and install one (1) one inch raceway for each two (2) future circuits for which "space" or "spare" provisions have been made in the panelboard. These raceways shall extend between the panelboard cabinet and a convenient location above an access panel or a removable tile ceiling construction and capped.
- 3.2 CLEANING
- A. Upon completion of installation of raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

END OF SECTION 26 0110

**SECTION 26 0120**  
**WIRES AND CABLES**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. This section is a Division 26 Basic Materials and Methods section and is part of each Division 26 Section making reference to wires and cables specified herein.

1.2 DESCRIPTION OF WORK

- A. Electrical wire and electrical cable work is indicated by drawings and specifications.
- B. Types of wire, cable and connectors in this section include, but not limited to the following:  
Copper conductors.  
Tap type connectors.  
Split-bolt connectors.
- C. Refer to other sections of Division 26 for, but not limited to, raceways, connections used in conjunction with wire and cable work.
- D. Applications for wire, cable and connectors required for project are as follows unless otherwise indicated:
1. Power Distribution Circuitry.
  2. Appliance and Equipment Circuitry.
  3. Motor Branch Circuitry.
  4. Control Circuitry.
  5. Signal/Communication Circuitry.

**PART 2 – PRODUCTS**

2.1 MANUFACTURERS

- A. Wire and Cable  
Anaconda Wire and Cable Co.  
Advance Wire and Cable, Inc.  
American  
Cerro Wire and Cable Co.  
Electrical Conductors, Inc.  
General Cable Corp.  
Hitemp Wires, Inc.  
Rome Cable Corp.  
Southwire Company  
Triangle PWC., Inc.  
General Electric Co.
- Connectors  
Burndy Corp.  
Eagle Electric Mfg. Co., Inc.  
Gould, Inc.

Ideal Industries, Inc  
Joslyn Mfg. and Supply Co.  
O-Z/Gedney Co.  
Pyle National Co.  
Thomas and Betts Co.

## 2.2 WIRE, CABLE AND CONNECTIONS

- A. Except as otherwise indicated, provide wire, cable and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, and as required for the installation. Minimum wire and cable size is #12 AWG for power and branch circuits and #14 AWG for control and signal/communication circuits unless otherwise indicated.
- B. Wire: Provide factory fabricated wire of sizes, ratings, materials and types indicated for each service. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements and NEC standards. Select from the following types, materials, conductor configurations, insulation and coverings:
- UL Type: THHN
  - UL Type: TW
  - UL Type: THW
  - UL Type: THWN
  - UL Type: TF
  - UL Type: XHHW
  - UL Type: AC (Armor Clad)
  - UL Type: MC (Metal Clad)
  - Material: Copper
  - Conductors: Solid (AWG 14 to AWG 10 only).
  - Conductors: Concentric-lay-stranded (standard flexibility)
  - Outer Covering: Nylon
  - Outer Covering: Thermoplastic
- C. Connectors: Provide factory fabricated metal connectors of sizes, ratings, materials, types and classes as required for each service. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and NEC standards. Select from the following types, classes, kinds and styles.
- Type: Pressure
  - Type: Crimp
  - Type: Threaded
  - Class: Insulated
  - Class: Non-insulated
  - Kind: Copper (for CU to Cu connection).
  - Style: Butt connection
  - Style: Elbow connection
  - Style: Combined "T" and straight connection

Style: "T" connection.

Style: Split-bolt parallel connection

Style: Tap connection

Style: Pigtail connection

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION**

- A. Install electrical cables, wires and connectors, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface. Pull conductors together where more than one is being installed in a raceway. Use pulling compound or lubricate, where necessary; compound must not deteriorate conductor or insulation. Use pulling means including fish tape, cable or rope which cannot damage raceway. Rope must be used as pulling means when pulling wires or cables into plastic conduit and duct. Keep conductor splices to a minimum and install in junction boxes only. No splices shall be permitted within conduit. Install splices and tapes which have mechanical strength and insulation rating equivalent or better than conductor. Use splice and tape connectors which are compatible with conductor material.

#### **3.2 FIELD QUALITY CONTROL**

- A. Prior to energization, test cable and wire for continuity of circuitry and also for short circuits. Correct malfunctions when detected.
- B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION 26 0120



**SECTION 26 0121**  
**WIRE CONNECTIONS AND DEVICES**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. This section is a Division 26 Basic Materials and Methods Section and is part of each Division 26 Section making reference to connectors and termination devices specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical connectors and termination work is indicated by drawings and specifications.
- B. Types of connectors and termination devices in this section include, but are not limited to the following:
  - 1. Tap type connectors.
  - 2. Split-bolt connectors.
- C. Refer to other sections of Division 26 for, but not limited to, raceways, wires and cables used in conjunction with connectors and termination devices.
- D. Applications for connectors and termination devices required for project are as follows unless otherwise indicated:
  - 1. Branch circuitry
  - 2. Equipment circuitry
  - 3. Control circuitry

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data on electrical connectors, high voltage termination to the Engineer.

**PART 2 – PRODUCTS**

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide connectors, high voltage terminations of one of the following manufacturers for each item used:

Burndy Corp.

Eagle Electric Mfg. Co., Inc.

Gould, Inc.

Ideal Industries, Inc.

Joslyn Mfg. and Supply Co.

O-Z/Gedney Co.

Pyle National Co.

Thomas and Betts Co.

Cooper Power Systems

2.2 CONNECTORS

- A. Provide factory fabricated metal connectors of sizes, ratings, materials, types and classes as indicated for each service. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and NEC standards.

- Type: Pressure  
Crimp  
Threaded
- Class: Insulated  
Non-Insulated
- Kind: Copper (for CU to Cu connection).
- Style: Butt Connection  
Elbow connection  
Combined "T" and straight connection  
"T" connection  
Split-bolt parallel connection  
Tap connection  
Pigtail connection

### **PART 3 – EXECUTION**

#### **3.1 600 VOLT CABLE CONNECTOR INSTALLATION**

- A. Install electrical connectors, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate cable, wire and connector installation work with electrical raceway and equipment installation work, as necessary for proper interface. Pull conductors together where more than one is being installed in a raceway. Use pulling compound or lubricate, where necessary, compound must not deteriorate conductor or insulation, and must be in accordance with wire and cable manufacturer's recommendations. Use pulling means including fish tape, cable or rope which shall not damage raceways including plastic conduits and ducts.

#### **3.2 FIELD QUALITY CONTROL**

- A. Prior to energization, test cable and wire for continuity of circuitry and also for short circuits. Correct malfunctions when detected.
- B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION 26 0121

**SECTION 26 0135**  
**ELECTRICAL BOXES & FITTINGS**

**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. This section is a Division 26 Basic Materials and Methods section, and is a part of each Division 26 section making reference to electrical wiring boxes and fittings specified herein.

1.2 DESCRIPTION OF WORK

- A. Types of electrical boxes and fittings in this section include the following:
  - Outlet boxes.
  - Junction boxes.
  - Pull boxes.
  - Conduit bodies.
  - Bushings.
  - Locknuts.
  - Knockout closures.
  - Sealing Fittings.

**PART 2 – PRODUCTS**

2.1 INTERIOR METALLIC OUTLET BOXES

- A. Provide galvanized flat rolled sheet steel interior outlet non-gangable wiring boxes, of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.
- B. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations. Choice of accessories is Installer's option.
- C. Manufacturer: Subject to compliance with requirements, provide interior outlet boxes of one of the following:
  - Appleton Electric Co.
  - Bell Electric/Square D Co.
  - Pass and Seymour, Inc.
  - RACO, Inc.
  - Steel City/Midland-Ross Corp.

2.2 WEATHERPROOF OUTLET BOXES

- A. Provide corrosion resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, including face plate gaskets and corrosion-resistant fasteners.
- B. Manufacturer: Subject to compliance with requirements, provide weatherproof outlet boxes of one of the following:
  - Arrow-Hart Div., Crouse-Hinds Co.

Bell Electric/Square D Co.

Harvey Hubbell, Inc.

O-Z/Gedney Co.

Slater Electric Co.

- C. Refer to Section 260140 – WIRING DEVICES for exterior receptacle outlet boxes.

### 2.3 JUNCTION PULL BOXES

- A. Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

- B. Manufacturers: Subject to compliance with requirements, provide junction and pull boxes of one of the following:

Adalet-PLM Div., Scott and Fetzer Co.

Appleton Electric Co.

Arrow-Hart Div., Crouse-Hinds Co.

Bell Electric/Square D Co.

GTE Corporation

Keystone Columbia, Inc.

O-Z/Gedney Co.

Slater Electric Co.

Spring City Elect. Mfg. Co.

### 2.4 CONDUIT BODIES

- A. Provide galvanized cast-metal conduit bodies, of types, shapes, and sizes, to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

- B. Manufacturers: Subject to compliance with requirements, provide conduit bodies of one of the following:

Appleton Electric Co.

Crouse-Hinds Co.

Gould, Inc.

Killark Electric Mfg. Co.

O-Z/Gedney Co.

Spring City Electrical Mfg. Co.

### 2.5 BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS

- A. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and insulated malleable iron conduit bushings, offset connectors, of types and sizes to suit respective uses and installation.

- B. Manufacturers: Subject to compliance with requirements, provide bushings, knockout closures, locknuts and connectors of one of the following:

Appleton Electric Co.

Burndy Corp.

Crouse-Hinds Co.

Gould, Inc.

O-Z/Gedney Co.

RACO, Inc.

Steel City/Midland-Ross Corp.

Thomas and Betts Co., Inc.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS**

- A. Install electrical boxes and fittings, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
- C. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install boxes and conduit bodies in those locations to ensure ready accessibility of electrical wiring.
- F. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surface.
- G. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- H. Provide electrical connections for installed boxes.
- I. Pull boxes and junction boxes shall be furnished and installed in all conduit runs at intervals not exceeding 100 feet maximum.
- J. Identify each circuit in all pull boxes and junction boxes whether the box contains one or more circuits.

END OF SECTION 26 0135



**SECTION 26 0140**  
**WIRING DEVICES**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. The extent of wiring device work is indicated by drawings, schedules and specifications. Wiring devices are defined as single discrete units of the electrical distribution system which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
  - Receptacles.
  - Switches.
  - Device plates.
  - Surface Receptacle Strip
  - Fire-Rated Poke-Thru Floor Outlet
  - Energy Control Devices

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's data on electrical wiring devices.

**PART 2 – PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of wiring device):
  - Legrand Co.
  - Hubbell, Inc.
  - Leviton Mfg. Co.
  - Lutron Electronics Co., Inc.
  - Cooper Wiring Devices
  - Square D Co.
  - Eaton Corp.
  - Siemens
  - Wattstopper

2.2 FABRICATED WIRING DEVICES

- A. Provide factory fabricated wiring devices, in types, styles, colors, and electrical ratings for applications indicated and complying with NEMA Standards Pub. No. WD 1. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements, and complying with NEC and NEMA Standards for wiring devices. Color selection to be verified by Contractor with Architect/Engineer.

2.3 RECEPTACLES

- A. All simplex receptacles shall be extra heavy duty, 20 amperes, 125 volts, 2 pole, 3 wire grounding, with green hexagonal equipment ground screw, with metal plaster ears, side wiring, NEMA configuration 5-20R unless otherwise indicated. Hubbell Cat. #HBL5361, or approved substitute.

- B. All duplex receptacles shall be extra heavy duty, 20 amperes, 125 volts, 2 pole, 3 wire grounding type with green hexagonal equipment ground screw, with metal plaster ears, side wiring, NEMA configuration 5-20R unless otherwise indicated. Hubbell Cat. #HBL5362, or approved substitute.
- C. Special Purpose Receptacles: Provide polarized grounding type special purpose receptacles of the required amperage and voltage ratings, extra heavy duty. Device shall include a green hexagonal equipment ground screw.
- D. All ground fault receptacles shall be extra heavy-duty duplex, tamper resistant, 20 amperes, 125 volts, 2 pole, 3 wire grounding type with green hexagonal equipment ground screw, integral ground fault circuit interrupter, UL rated Class A, Group 1, with metal plaster ears, side wiring, NEMA Configuration 5-20R, self-testing with red and green LED indicator lights. Device shall include solid state ground-fault sensing and signaling, with a 5 milliamperere ground fault trip level, plus or minus 1 milliamperere. Hubbell Cat. #GFR5362SG, or approved substitute.
  - 1. Whether indicated or not on the floor plans, the Electrical Contractor shall furnish and install GFI protected devices in kitchen areas on countertops near sinks, water coolers, refrigerators, on rooftop equipment, on exterior walls; and as indicated by the N.E.C., it shall be the discretion of the Electrical Contractor to provide GFI receptacles or GFI circuit breaker. Receptacles protected by GFI circuit breakers shall be permanently labeled on the faceplate as GFCI.

#### 2.4 SWITCHES

- A. Toggle Switch: Provide extra heavy duty, industrial series flush toggle, 1 pole, 2 pole, 3-way, 4-way AC quiet switch rated 20 amperes @ 120/277 volts with green hexagonal equipment ground screw, metal plaster ears, and side wired screw terminals. Similar to Hubbell Series HBL Series or approved substitute.
- B. Key Switch: Provide extra heavy duty, industrial, 1 pole, 2 pole, 3-way, 4-way barrel key locking switch rated at 20 AMPs @ 120/277 volts with green grounding screw, metal plaster ears and side wired screw terminals. The tumbler shall be a six-point cylinder type. All project keyed switches to be keyed alike. Similar to Hubbell 122\*RKL series.

#### 2.5 DEVICE PLATES

- A. Provide switch and receptacle outlet wall plates for wiring devices, of types, sizes, and with ganging and cut outs required by the devices being installed. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates; plates colored to match wiring devices to which attached. Provide device plates possessing the following additional construction features: **Receptacle outlet plates to be permanently marked with panel designation and circuit number on back side of plate.**
  - 1. Metal Plates to be stainless steel of non-corrosive and non-magnetic 302 alloy, .032" nominal thickness. Plates shall have brushed satin finish.
- B. Weatherproof device plates shall have spring-hinged waterproof cap suitably configured for each application, including face plate gaskets and corrosion-resistant fasteners. Boxes and devices shall be recessed, weatherproof with smoke gray opaque in-use covers. Intermatic Cat. #WP1000(H)GRC.
- C. Existing mechanical spaces where concealed work is impractical, such as masonry or block walls, provide 4" square boxes, surface mounted, with ½" deep surface mounted device plates consisting of same material for devices indicated on plans, whether single or double gang. Use of plaster flange and standard cover plate will not be acceptable.

#### 2.6 FIRE-RATED POKE-THRU FLOOR OUTLET

- A. Provide complete fire-rated assembly poke-thru device of type Hubbel; Syste, one 10" with four (4) 20A receptacles capable of being wired for isolated ground, six (6) Ortronics Cat 6 jacks for data and brass cover flange or approved equal.

## 2.7 ENERGY CONTROL DEVICES (Occupancy Sensors)

### A. Line Voltage:

1. Combination wall switch and sensor shall be Dual Technology Passive Infrared and Ultrasonic, designed for single gang outlet box installation, with a coverage of 180° for a maximum of 400 square feet. Device shall be suitable for 120/277 dual voltage operation, and have vandal resistant, hard sensor lens. Device shall be similar to Sensor Switch Cat. No. WSD-PDT or Wattstopper DW-100 Series, DW-103 Series for multi-way, DW-200 for dual relay, DW-203 for multi-way dual relay, or approved substitute.
2. Ceiling sensor shall be Dual Technology Passive Infrared and Ultrasonic 360° coverage, 1200 square feet maximum. Self Contained Relay Device shall be suitable for 120/277 Dual Voltage operation. Device shall be similar to Sensor Switch Cat. No. CMR-PDT, Wattstopper DT-355 or approved substitute.

### B. Low Voltage:

1. Ceiling mounted sensor shall be Dual Technology Passive Infrared and Ultrasonic with 360° coverage up to 20 feet. Device accepts 12 to 24 volt AC or DC. Device shall be similar to Sensor Switch Cat. No. CM-PDT or approved substitute.
2. Sensor power pack shall be a low voltage power supply with an input of either 120 volts or 277 volts AC and an output of 24 volts DC @ 150 mA. Device shall contain a 20 AMP isolated load control relay. When relay is used, power supply output shall be reduced to 24 volts DC @ 114 mA. Device shall be similar to Sensor Switch PP-20 or approved substitute.

### C. Photocontrol

1. Provide epoxy conformal coated cadmium sulphide photocell with Lexan impact and vandal resistant enclosure. Dome and base to be ultrasonically welded. Photocell shall respond to the light spectrum near to that of a human eye. Housing shall mount to ½" conduit and have 180° swivel.
2. Photocell shall have on/off time delay, on at 1 to 5 FC, off at 3 to 15 FC. Tool free adjustment. Unit shall fail in the ON position.
3. Unit shall operate from -40°F to 140°F, with a minimum 5-year warranty.
4. Provide Tork 2001 series or approved equivalent.

## PART 3 – EXECUTION

### 3.1 INSTALLATION OF WIRING AND CONTROL DEVICES

- A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes which are clean, free from building materials, dirt and debris.
- D. Provide electrical connections for wiring and control devices.
- E. Delay installation of all wiring and control devices until wiring work is completed.
- F. Isolated Ground Receptacle Devices shall be connected to the system ground by way of an insulated ground conductor color coded green with a yellow stripe.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES

- A. At time of Substantial Completion, replace those items which have been damaged, including those burned and scorched by faulty plugs.

3.3 GROUNDING

- A. Provide electrically continuous, tight grounding connections for wiring and control devices.

3.4 TESTING AND COMMISSIONING

- A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.
- B. After energizing circuitry, the Electrical Contractor shall test and adjust all control devices to provide optimum operation and performance.
- C. All areas where energy control devices are specified shall be verified for full coverage and accurate operation. If any area is determined by the Owner, Architect, or Engineer to have inadequate coverage or operation, Contractor shall provide additional energy control devices to remedy the coverage or operation issue. For bidding purposed, own 5 extra devices fully installed. After successful commissioning, uninstalled devices shall be handed over to the Owner for spare devices. Device types shall be as required for commissioning, or as selected by Owner for space devices as applicable.

END OF SECTION 26 0140

**SECTION 26 0155**  
**MOTOR STARTERS**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Extent of motor starter work is indicated by drawings, schedules and specifications.
- B. Refer to sections of other divisions of these specifications for driven equipment specified without motor starters. Motor starters for such equipment are the work of this section.
- C. Types of motor starters in this section include the following:
  - Manual.
  - Magnetic Full Voltage, Non-Reversing.
  - Combination Disconnect Switch and Magnetic Starter.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's data on motor starters and accessories.

1.3 COORDINATION

- A. The drawings and details there upon are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate with other Division subcontractors, the installation of all motor starters, the need for control devices including the wiring and conduit, to and from the device.
- B. This coordination shall be carried out prior to actual installation. This shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of coordination.
- C. During the coordination phase of the project, the Electrical Contractor shall consult with Division 1 thru 23 subcontractors with regard to base design equipment characteristics. Any differences from the electrical plans and specifications shall be considered a change. The trade's contractor making the change at no additional cost to the Owner or delay in project completion shall handle these additional costs.

**PART 2 – PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):
  - Allen-Bradley Co.
  - Cutler Hammer Products
  - Furnas Electric Co.
  - Square D Co.
  - Siemens

2.2 MOTOR STARTERS

- A. Provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installations.
- B. Fractional HP Manual Motor Starters: Provide manual, single phase, fractional HP motor starters for each motor rated less than 1/2 HP, of types, ratings and electrical characteristics indicated. Equip unit with thermal overload relay for protection of 120 volt AC motors. Provide starters with quick-make,

quick-break, trip free toggle mechanisms, selector switches for hand-off-automatic control; mount starter in NEMA Type 1 or Type 4 enclosure as indicated or required by the NEC.

- C. **Magnetic Motor Starter:** Provide magnetic full voltage, non-reversing starters for each motor rated 1/2 HP and more of types, ratings and electrical characteristics indicated; equip with solid state overload relays, control transformers with 120V secondary, with one secondary fuse and one grounded secondary lead, two normally open and two normally closed auxiliary contacts, hand-off- automatic selector switch, red and green pilot lights wired and mounted through front of the enclosure. Mount starter in NEMA Type 1 or Type 4 enclosure as required by the NEC.
- D. **Combination Disconnect Switch Magnetic Starter:** Provide full-voltage, non-reversing, combination non-fused disconnect switch and magnetic starter for each motor rated 1/2 horsepower and more, of types, ratings and electrical characteristics indicated; equip with solid state overload relays, control transformer with 120 volt secondary, one secondary fuse and one grounded secondary lead, two normally open and two normally closed auxiliary contacts, hand-off- automatic switch, red and green pilot lights wired and mounted through the front of the enclosure. Mount starter in NEMA Type 1 or Type 4 enclosure as required by the National Electrical Code (NEC).
- E. **Three (3) phase, full voltage, non-reversing magnetic motor starters, horsepower rating with minimum NEMA size #0 shall be as follows:**

NEMA Size	Continuous Rating	Maximum Horsepower	
		208 Volt	480 Volt
0	18 AMPs	3HP	5HP
1	27 AMPs	7-1/2HP	10HP
2	45 AMPs	10HP	25HP
3	90 AMPs	25HP	50HP
4	135 AMPs	40HP	100HP
5	270 AMPs	75HP	200HP

Motor full-load current shall not exceed continuous ampere rating of starter.

**PART 3 – EXECUTION**

**3.1 INSTALLATION OF MOTOR STARTERS**

- A. Install motor starters in accordance with manufacture's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. The Electrical Contractor shall consult and cooperate with the Control Contractor in assisting him in making control connections to the automatic position of the selector switch and to the auxiliary contacts.
- C. **Motor Data:** Before installing wiring for motors and starters, the Electrical Contractor shall consult the respective parties furnishing the equipment and obtain from them all data necessary to properly connect the apparatus, and for selection of thermal overload relays in accordance with motor nameplate. Any variance in loads or electrical characteristics from the contract drawings should be reported to the Engineer before proceeding with the work.

- D. When packaged equipment is furnished, all unit starters shall be furnished, mounted and wired by the installing contractor. The Electrical Contractor shall furnish and install a disconnect switch, as specified in Section 260170, and wire between unit's main terminal block and the disconnect switch.
  - E. When packaged rooftop equipment is furnished, the unit disconnect switch and all starters shall be furnished, mounted and wired by the installing contractor. The Electrical Contractor shall wire between the line side of the disconnect switch and the building system.
  - F. Should the Electrical Contractor elect to furnish and install an electric alternator with magnetic starters in lieu of the duplex motor controller, he shall provide all control wiring needed to make the alternator and the starters function as a unit.
  - G. Provide connections for motor starters.
- 3.2 ADJUST AND CLEAN
- A. Inspect operating mechanisms for malfunctioning and where necessary adjust units for free mechanical movement.
  - B. Touch-up scratched or marred surfaces to match original finish.
- 3.3 FIELD QUALITY CONTROL
- A. Subsequent to wire/cable hookup, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION 26 0155



**SECTION 26 0170**  
**MOTOR AND CIRCUIT DISCONNECTS**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedules.
- B. Types of motor and circuit disconnect switches in this section include the following:
  - Equipment disconnects.
  - Appliance disconnects.
  - Motor-circuit disconnects.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of motor and circuit disconnect switch required.

1.3 COORDINATION

- A. The drawings are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all motor and circuit disconnect switches, supporting hardware, including wiring and conduit, to and from the equipment. This coordination will include conduit layout to allow access to equipment for maintenance.
- B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.
- C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

**PART 2 – PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of switch):
  - Cutler-Hammer, Inc. (Eaton)
  - Square D Company
  - Siemens

2.2 FABRICATED SWITCHES

- A. Safety Switches: Safety switches shall be of sizes noted on the drawings, fusible or non-fusible and contained in a general purpose enclosure. All switches shall be type HD and have quick-make, quick-break operation. All switches shall be of proper horsepower rating as applicable and have dual interlocks designed to interlock the switch box door with the switch operating mechanism. Unit shall be provided with a suitable means of interlock release. An arrangement shall be provided for locking the operating handle in the "ON" or "OFF" position. Safety switches shall have the proper type metal enclosure, i.e., standard, weatherproof, etc., to suit their specific location as required by the National Electrical Code.
- B. Fuses: Provide fuses for safety switches, as recommended by switch manufacturer, of classes, types and ratings needed to fulfill electrical requirements for service indicated.

- C. When packaged rooftop equipment is furnished, the unit disconnect switch shall be furnished, mounted and wired by the installing contractor.
- D. When rooftop exhaust fans rated less than 1/2 HP at 120 volts, single phase, are furnished, except utility sets, the unit disconnect switch shall be furnished, mounted and wired by the installing contractor.

**PART 3 – EXECUTION**

**3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES**

- A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Install disconnect switches used with motor-driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.
- C. Provide electrical connections for motor and circuit disconnect switches.

END OF SECTION 26 0170

**SECTION 26 0180**  
**OVERCURRENT PROTECTIVE DEVICES**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Extent of overcurrent protective device work is indicated by drawing schedules and specifications.
- B. Types of overcurrent protective devices in this section include the following:
  - 1. Molded case circuit breaker.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's data on overcurrent protective devices, including: voltages and current ratings, interrupting ratings, current limitations, internal inductive and non-inductive loads, time-current trip characteristic curves, and mounting requirements.
- B. Shop Drawings: Submit layout drawings of overcurrent protective devices, showing spatial relationships of units to associated electrical equipment, and connections to electrical power supplies.

**PART 2 – PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:
  - 1. Circuit-Breakers
    - Cutler-Hammer, Inc. (Eaton)
    - Square D Co.
    - Siemens

2.2 CIRCUIT BREAKERS

- A. Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, as required for a complete installation.
- B. Molded-Case Circuit Breakers: Provide factory assembled, molded-cased circuit breakers of frame size indicated; 120/208 volts, and 277/480 volts 60 Hertz, one, two, or three poles with a short circuit symmetrical ampere interrupting rating as indicated by the panel schedule and/or as shown by the single line riser diagram. Provide circuit breakers with permanent thermal instantaneous magnetic trips in each pole with ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct devices for mounting and operating in any physical position and operating in an ambient temperature of 40 degrees C. Provide circuit breakers with mechanical screw type connector lugs, AL/CU rated.

**PART 3 – EXECUTION**

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES

- A. Install overcurrent protective devices as indicated in contract documents, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC Standards for Installation of

overcurrent protective devices.

- B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices with other work.
- C. Fasten circuit breakers without causing mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.

### 3.2 ADJUST AND CLEAN

- A. Inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

### 3.3 FIELD QUALITY CONTROL

- A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 26 0180

**SECTION 26 0190**  
**SUPPORTING DEVICES**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Types of supports, anchors, sleeves and seals specified in this section include the following:
- Hangers.
  - Riser Clamps.
  - C-clamps
  - I-beam clamps.
  - One-hole conduit straps.
  - Two-hole conduit straps.
  - Round steel rods.
  - Lead expansion anchors.
  - Toggle bolts.
  - U-Channel Strut Systems.

**PART 2 – PRODUCTS**

2.1 MANUFACTURED SUPPORTING DEVICES

- A. Provide supporting devices, complying with manufacturer's standard materials, design and construct in accordance with published product information, and as required for a complete installation, and as herein specified.
- B. Supports: Provide supporting devices of types, sizes and materials having the following construction features:
- Hangers: For supporting EMT conduit, electro-galvanized steel, with 1/4" minimum diameter hole for round steel rod; approximately MSS types 5, 7, 9 or spring steel conduit clips.
  - Reducing Couplings: Steel rod reducing coupling, 1/4" minimum black steel.
  - C-Clamps: Black malleable iron, 1/4" minimum rod size.
  - I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approx. 52 pounds per 100 units.
  - One-Hole Conduit Straps: For supporting EMT conduit, electro- galvanized steel.
  - Two-Hole Conduit Straps: For supporting EMT conduit, electro-galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
  - Hexagon Nuts: For 1/4" rod size; galvanized steel.
  - Round Steel Rod: Black steel; 1/4" min. dia.
  - Offset Conduit Clamps: For supporting rigid metal conduit; black steel.
- C. Anchors: Provide anchors of types, sizes and materials indicated; and having the following construction features:
- Lead Expansion Anchors: 1/4" - 20 Minimum.
  - Toggle Bolts: Springhead; 3/16 x 4".
- D. Manufacturer: Subject to compliance with requirements, provide anchors of the following:
- Ackerman Johnson Fastening Systems, Inc.

Elcen Metal Products Co.  
Ideal Industries, Inc.  
Rawlplug Co., Inc.  
Star Expansion Co.  
U.S. Expansion Bolt Co.  
Erico Products, Inc. (Caddy)  
Hilti, Inc.

- E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 16-gauge hot dip galvanized steel, construct with 9/16" dia. holes, 8" o.c. on top surface, with standard hot dip galvanized finish, and with the following fittings which mate and match with U-channel.
- Beam clamps.  
Thinwall conduit clamps.  
Conduit hangers.  
U-bolts.
- F. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following:
- B-Line Systems, Inc.  
Elcen Metal Products Co.  
Power-Strut Div.; Van Huffel Tube Corp.  
Unistrut Div.; GTE Products Corp.  
Hilti, Inc.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION OF SUPPORTING DEVICES**

- A. Install hangers and anchors in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.
- B. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with maximum spacings.

END OF SECTION 26 0190

**SECTION 26 0452**  
**GROUNDING**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Types of grounding in this section include the following:

Grounding:

Underground metal piping.

Underground metal water piping.

Grounding rods.

Service equipment.

Enclosures.

Systems.

Equipment.

Building Structural Steel (Bonding)

**PART 2 – PRODUCTS**

2.1 GROUNDING

- A. Except as otherwise indicated, provide each electrical grounding system indicated, with assembly of materials including, but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA, and established industry standards for applications indicated.

- B. Provide conduit, tube, duct, cable and fittings complying with Division 26 Basic Materials and Methods section, "Raceways", in accordance with the following listing:

Rigid steel conduit.

Electrical metallic tubing.

Flexible metal conduit.

Liquid-tight flexible metal conduit.

Rigid metal conduit fittings.

EMT fittings.

Flexible metal conduit fittings.

Liquid-tight flexible metal conduit fittings.

Manufactured Cabling Systems

2.2 ELECTRICAL GROUNDING CONDUCTORS

- A. Unless otherwise indicated, furnish a green insulated equipment grounding conductor for all feeders and branch circuits, matching power supply wiring materials and sized according to NEC.

2.3 BONDING PLATES, CONNECTIONS, TERMINALS & CLAMPS

- A. Provide electrical bonding plates, connectors, terminals and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for applications.

2.4 GROUND RODS & PLATES

- A. Ground Rods: Steel with copper welded exterior, 3/4" dia. x 10'.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION OF GROUNDING SYSTEMS**

- A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding complies with requirements. Comply with requirements of NEC, NESC, NEMA and UL standards for installation of grounding systems.
- B. Coordinate with other electrical work as necessary to interface installation of grounding system with other work.
- C. Clamp cable connections to ground rods.
- D. Install bonding jumpers with ground clamps on water meter piping to electrically bypass water meter.
- E. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

#### **3.2 FIELD QUALITY CONTROL**

- A. Upon completion of installation of electrical grounding system, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms or less by driving additional ground rods and/or by chemically treating soil encircling ground rods with sodium chloride, calcium chloride, copper sulphate, or magnesium. Then retest to demonstrate compliance.

END OF SECTION 26 0452

**SECTION 26 0460**  
**TRANSFORMERS**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Extent of transformer work is indicated by drawings and schedules.
- B. Types of transformers in this section include the following:  
Dry type transformers

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's data on power/distribution transformers, including certification of transformer performance efficiency at indicated loads, percentage regulation at 100% and 80% power factor, no-load and full-load losses in watts, % impedance at 75 Degrees C, hot-spot and average temperature rise above 40 degrees C ambient, sound level in decibels and standard published data including dimensions and net and shipping weights.
- B. Shop Drawings: Submit dimensioned drawings of transformer installations, showing mountings and supports.

**PART 2 – PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):

Dry

Sorgel Electric Division/Square D Company

Cutler-Hammer/Eaton Electrical, Inc.

The ABB Group

Siemens Energy & Automation, Inc.

Mirus International, Inc.

Approved Substitute.

2.2 POWER/DISTRIBUTION TRANSFORMERS

- A. General Requirements:
  - 1. Except as otherwise indicated, provide manufacturer's standard materials and components as indicated in contract documents and by published product information designed and constructed as recommended by manufacturer, and as required for complete installation.

2.3 HARMONIC MITIGATING ISOLATION TRANSFORMERS: (T-3)

- A. Furnish an isolation transformer with low zero sequence output impedance designed to reduce the voltage distortion created by the 3<sup>rd</sup> and other triplen harmonic currents. Primary-secondary phase shift permits cancellation of 5<sup>th</sup>, 7<sup>th</sup>, 17<sup>th</sup> and 19<sup>th</sup> harmonic currents with those of other loads fed from the same primary supply. Transformer shall be Energy Star rated and be compliant with NEMA Standard TP-1.
- B. Furnish an open ventilated, three (3) phase, common core unit with copper windings. Unit voltage and KVA rating shall be as indicated on the floor plans and/or single line diagram. Transformers shall have a insulation class 220 degrees C. and a temperature rise rating of 80 degrees C. Unit shall be furnished with a full load efficiency of 97% minimum at 170 degrees C. and two (2) full load taps above normal and two (2) full load taps below normal. Transformer shall have single electrostatic

shielding rated 60dB attenuation.

- C. Enclosure shall be an open ventilated, NEMA-1, general purpose, finished in grey with anti-vibration pads between the core and the enclosure.
- D. Transformer shall be similar to Mirus International, Inc., Model Harmony-1, 2 or 3, based on the quantity of feeder taps or approved equal.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION OF TRANSFORMERS**

- A. Install transformers as indicated in contract documents, and complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and IEEE Standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Install units on vibration mounts; comply with manufacturer's installation method if any.

#### **3.2 GROUNDING**

- A. Provide tightly fastened equipment grounding and bonding connections for transformers.

#### **3.3 TESTING**

- A. Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunction units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 26 0460

**SECTION 26 0470**  
**DISTRIBUTION CIRCUITS**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Distribution circuit work is indicated by drawings and schedules.
- B. The distribution circuits shall include furnishing and installing a complete wire and conduit system between distribution panelboards and branch circuit panelboards.
- C. Types of equipment to be furnished and installed in this section include the following:
  - Rigid Metal Conduit
  - Intermediate Metal Conduit (IMC)
  - Electrical Metallic Tubing (EMT)
  - PVC (Below Slab Only)
  - Wires and Cables
  - Junction Boxes
  - Pull Boxes
  - Conduit Bodies
  - Bushings
  - Locknuts
  - Supporting Devices

**PART 2 – PRODUCTS**

2.1 DISTRIBUTION CIRCUITS

- A. Furnish and install each distribution circuit indicated, with assembly of materials, including but not necessarily limited to, conduit, wire, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

**PART 3 – EXECUTION**

3.1 INSTALLATION OF DISTRIBUTION CIRCUITS

- A. Install distribution circuits complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Multiple circuits within a single raceway shall not be permitted under this section.

END OF SECTION 26 0470



**SECTION 26 0471**  
**FEEDER CIRCUITS**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Feeder circuit work is indicated by drawings and schedules.
- B. The feeder circuits shall include furnishing and installing a complete wire and conduit system between distribution panelboards and major 3 phase loads, between power panels and 3 phase motor loads.
- C. Types of equipment to be furnished and installed in this section include the following:
  - Rigid Metal Conduit
  - Electrical Metallic Tubing (EMT)
  - Intermediate Metal Conduit (IMC)
  - Wires and Cables
  - Junction Boxes
  - Pull Boxes
  - Conduit Bodies
  - Bushings
  - Locknuts
  - Supporting Devices

**PART 2 – PRODUCTS**

2.1 FEEDER CIRCUITS

- A. Furnish and install each feeder circuit with assembly of materials, including but not necessarily limited to, conduit, wire, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

**PART 3 – EXECUTION**

3.1 INSTALLATION OF FEEDER CIRCUITS

- A. Install feeder circuits, complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Multiple circuits within a single raceway shall not be permitted under this section.

END OF SECTION 26 0471



**SECTION 26 0472**  
**BRANCH CIRCUITS**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Branch circuit work is indicated by drawings.
- B. The branch circuits shall include furnishing and installing a complete wire and conduit or cable system between panelboards and lighting fixtures, receptacles, fractional horsepower motors, and small single phase loads.
- C. Types of equipment to be furnished and installed in this section include the following:
  - Rigid Raceways – See Section 260110
  - Electrical Metallic Tubing (EMT)
  - MC (Metal Clad) (Concealed Work only)
  - Wires and Cables
  - Junction Boxes
  - Pull Boxes
  - Conduit Bodies
  - Bushings
  - Locknuts
  - Supporting Devices

**PART 2 – PRODUCTS**

2.1 BRANCH CIRCUITS

- A. Furnish each branch circuit with an assembly of materials, including but not necessarily limited to, conduit, wire, cable, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

2.2 CONVENIENCE BRANCH CIRCUITS

- A. Intent:
  - 1. The intent of this portion of the specifications is to describe the requirements of a convenience circuit as it applies to 120-volt receptacles.
  - 2. All convenience branch circuits may consist of more than one 120 volt receptacle.
- B. Convenience Circuit - General: A circuit consisting of a phase and neutral conductor, which may share its neutral with other phase conductors provided that the neutral conductor does not become overloaded due to circuit phase relationship. This type of circuit shall also include an equipment grounding conductor as described under the grounding section of the specifications.
- C. Convenience Circuit - Dedicated: A circuit consisting of a phase and neutral conductor which DOES NOT share conductors with any other circuits. This type of circuit shall also include an equipment grounding conductor as described under the grounding section of the specifications.

**PART 3 – EXECUTION**

3.1 INSTALLATION OF BRANCH CIRCUITS

- A. Install branch circuits, complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with

recognized industry practices.

- B. Multiple circuits within a single raceway or cable shall be permitted under this section. It shall be the responsibility of the Electrical Contractor to assure that the neutral conductors do not become overloaded due to circuit phase relationship, and isolated grounds not become voided or compromised due to miswiring or wrong connections.
- C. The Electrical Contractor may elect to use metal clad cable in lieu of electrical metallic tubing (EMT) in wall cavities, and/or above tile or dry wall ceilings. In all areas of exposed construction, electrical metallic tubing (EMT) shall be installed.

END OF SECTION 26 0472

**SECTION 26 0510**  
**BUILDING LIGHTING**

**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. Lighting fixture work is indicated by specifications, drawings and schedules.
- B. Types of lighting fixtures in this section include the following:
  - 1. LED
- C. Applications of lighting fixtures required for the project include the following:
  - 1. General Lighting.
  - 2. Supplementary Lighting.
  - 3. Emergency Lighting.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's data on building lighting fixtures.
- B. Shop Drawings: Submit dimensioned drawings of lighting fixture installations, including but not necessarily limited to, layout, relation to associated panelboards, and connections to panelboards. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet.

**PART 2 – PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

- A. Each lighting fixture type specified represents a specific style and quality of fixture acceptable for this project.
- B. The Engineer reserves the right to reject any shop drawing and to request a resubmission should the contractor submit a shop drawing of an equivalent manufacturer which is viewed as being of an incompatible style or inferior quality.
- C. No fixture shop drawing shall be submitted, nor will any be accepted, for any manufacturer which is not specifically listed for that fixture type. When a fixture manufacturer is listed for a specific fixture type, this does not provide him with the right to submit for fixtures he is not listed under. A bidding Contractor may elect to bid using non listed fixtures for the listed Lighting Representatives. The Engineer and the Architect shall make the final decision on whether the submitted fixture meets the project's requirements during shop drawing review.
- D. Should the Contractor be unable to obtain approval of the resubmitted manufacturer, then he should submit the basis of design specified manufacturer/fixture.

2.2 LIGHTING FIXTURES

- A. Provide lighting fixtures of the size, type and rating indicated complete with, but not necessarily limited to, housings, lamp holders, reflectors, ballast, lamps, mounting frames, pendants and wiring; wired and connected in place, complete, tested and left in satisfactory operating condition.
- B. LED Drivers
  - 1. All LED fixtures shall be provided with integral drivers (unless noted otherwise) and must operate at line voltage as indicated on drawings (unless noted otherwise).
  - 2. LED drivers shall have operating temperature of 50°F - 140°F unless noted otherwise.

3. LED drivers shall carry a 5-year warranty.
- C. Fixture Lamps: For the type, number and color of the fixture lamps, refer to the Lighting Fixture Schedule on the drawings.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION OF LIGHTING FIXTURES**

- A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA Standards and with recognized industry practices to ensure that lighting fixtures fulfill requirements of the project.
- B. Install lighting fixtures in removable tile ceilings using 3/8" flexible metal conduit with 3 # 12 awg. conductor. Maximum length of flexible lead shall not exceed 60". Flexible lead shall extend from the fixture to the junction box. The junction box shall be securely fastened to the building structure above the removable tile ceiling and shall not serve more than two (2) lighting fixtures, nor shall the junction box support any of the lighting fixtures.

#### **3.2 LIGHTING FIXTURE MOUNTING**

- A. 1' x 4', 2' x 2' and 2' x 4' fixtures installed in a removable tile ceiling shall be installed using T-Bar grid safety clips as provided by the fixture manufacturer and as required by the NEC.
- B. 2'x 2' and 2' x 4' fixtures installed in a removable tile ceiling shall be installed using support wires at all four corners of the fixture. The support wires shall be carried up to the building structure and securely anchored using screwed or bolted hardware. Pressure type clips will not be acceptable. The Electrical Contractor shall be responsible for installing or having installed these four (4) support wires.
- C. 1' x 4' fixtures installed in a removable tile ceiling shall be installed using support wires at two (2) corners of the fixture. The support wires shall be carried up to the building structure and securely anchored using screwed or bolted hardware. Pressure type clips will not be acceptable. The Electrical Contractor shall be responsible for installing or having installed these Two (2) support wires.
- D. Downlights installed in a removable tile ceiling shall be installed using 24" spreader bars attached to the T-Bar grid system. Two (2) support wires shall be installed, one (1) on each side of the fixture and centered between the spreader bars, these support wires shall be carried up to building structure and securely anchored using screwed or bolted hardware. Pressure type clips will not be acceptable. The Electrical Contractor shall be responsible for installing or having installed these two (2) support wires.
- E. Pendant lighting fixtures, either chain, cable or stem hung below a removable tile ceiling shall be installed in accordance with fixture manufacturer's written instructions and recommendations. The Electrical Contractor shall furnish and install support wire or threaded rod from the fixture mounting hardware up to building structure and securely anchor using screwed or bolted hardware. Pressure type clips will not be acceptable. These support devices shall be independent from the ceiling T-Bar grid system, the system may be used as a guide, but in no way shall the T-Bar grid system carry any of the weight produced by the fixture or it's support devices.
- F. Surface mounted fixtures installed on removable tile ceilings or dry wall ceilings shall be installed in accordance with fixture manufacturer's written instructions and recommendations.
  1. Fixtures installed on removable tile ceilings shall be anchored to the T-Bar grid system using snap-on clips with threaded studs and wing nuts. The Electrical Contractor shall furnish and install a support wire from each snap-on clip carried up to building construction and securely anchor using screwed or bolted hardware.

2. Fixtures installed on dry wall ceilings shall be mounted using spring-loaded toggle bolts. The number and location of the anchors shall depend on the fixture manufacturer's written instructions and recommendations. It shall be the responsibility of the Electrical Contractor to follow these instructions and recommendations.

3.3 ADJUST and CLEAN

- A. Clean lens, reflectors and interiors of all lighting fixtures of dirt and construction debris upon completion of installation.
- B. Protect installed lighting fixtures from damage during the remainder of the construction period.

3.4 FIELD QUALITY CONTROL

- A. Upon completion of the installation of the lighting fixtures, and after the building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with project requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- B. At the time of Substantial Completion, replace lamps in lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by the Architect/Engineer. Furnish stock or replacement lamps amounting to 15% (but not less than one (1) lamp in each case) of each type and size used in each type of fixture. Deliver the replacement stock as directed to the Owner's storage area.
  1. Refer to Division 1 sections for the replacement/restoration of lamps in lighting fixtures, where used for temporary lighting prior to the time of Substantial Completion.
- C. Replace defective and burned out lamps for a period of one (1) year following the time of Substantial Completion.

3.5 GROUNDING

- A. Provide tight equipment grounding connections for each lighting fixture installation, in accordance with fixture manufacturer's recommendations and the NEC's requirements.

END OF SECTION 26 0510