ADDENDUM NO. 1

TO

RED CLAY CONSOLIDATED SCHOOL DISTRICT
CONRAD SCHOOLS OF SCIENCE
BID PACKAGE 'A'

This addendum is hereby made part of the Project Manual and Drawings dated February 9, 2015.

The Project Manual and Drawings shall be supplemented or amended as specified herein.

This Addendum contains changes to the requirement of the Project Manual. Such changes shall be incorporated into the Contract Documents and shall apply to work with the same meaning and force as if they had been included in the original Documents. Whenever this Addendum modifies a portion of a paragraph of the Project Manual, the remainder of the paragraph affected shall remain in force. Added information is shown as **Bold,** deleted information is shown as ~~strikethrough~~**.**

This Addendum contains changes to the requirement of the Drawings. Such changes shall be incorporated into the Contract Documents and shall apply to work with the same meaning and force as if they had been included in the original Documents. Whenever this Addendum modifies a portion of any drawing, the remainder of the drawing affected shall remain in force. Added, deleted or revised information is shown as "clouded".

The conditions and terms of the basic Contract Documents shall govern work unless otherwise described in this Addendum. Whenever the conditions of work, and the quality or quantity of materials, or workmanship are not fully described in this Addendum, the conditions of work included in the basic Contract Documents for similar items of work shall apply to the work described in this Addendum.

If no similar items of work are included in the basic Contract Document, the best quality of material and workmanship shall apply and all work shall be subject to the written acceptance of the Architect.

THE BID OPENING DATE REMAINS THE SAME. ALL BIDS ARE DUE AT THE RED CLAY CONSOLIDATED SCHOOL DISTRICT OFFICE 1798 LIMESTONE RD, WILMINGTON, DELAWARE 19804 UNTIL 2:00 P.M. LOCAL TIME ON MARCH 11, 2013.

THE LAST DAY FOR QUESTIONS IS WEDNESDAY, MARCH 4, 2015.

BIDDERS ARE ADVISED THAT THE ONLY RELIABLE SOURCE OF DOCUMENTS FOR THIS SOLICITATION IS THE EDIS FTP SITE. BIDDERS THAT RELY ON INFORMATION PUBLISHED ON ANY OTHER COMMERCIAL WEBSITES DO SO AT THEIR OWN RISK.

BIDDERS CAN CONTACT DARIN KELLAM TO SCHEDULE A SITE VISIT AT 302-528-0103.

Addendum No. 1 – Consists of the following:

I. Response to Bidders' Questions

II. Revisions to Project Manual/Specifications

III. Revisions to Drawings

I. RESPONSES TO BIDDERS' QUESTIONS

A. N/A

II. REVISIONS TO PROJECT MANUAL/SPECIFICATIONS

A. SECTION 000110 – TABLE OF CONTENTS - DELETE this section in its entirety and INSERT new section attached.

B. SECTION 000115 – LIST OF DRAWINGS - DELETE this section in its entirety and INSERT new section attached.

C. SECTION 001113 – ADVERTISEMENT FOR BID - DELETE this section in its entirety and INSERT new section attached.

D. SECTION 011100 – SUMMARY OF WORK - DELETE this section in its entirety and INSERT new section attached.

E. SECTION 013500 – CONTRACTOR EMPLOYEE BACKGROUND CHECK - DELETE this section in its entirety and INSERT new section attached.

F. ADD the following attached specifications sections:

02 4100 Demolition
04 2000 Unit Masonry
06 1000 Rough Carpentry
06 2000 Finish Carpentry
07 9005 Joint Sealers
08 1113 Hollow Metal Doors and Frames
08 4313 Aluminum-Framed Storefronts
08 7102 Door Hardware
08 8000 Glazing
09 2116 Gypsum Board Assemblies
09 2300 Gypsum Plastering
09 3000 Tiling
09 5100 Acoustical Ceilings
09 6500 Resilient Flooring
09 9001 Paints and Coatings
10 2800 Toilet Accessories
230200 General Provisions – HVAC
230210 Basic Materials and Methods – HVAC
230215 Valves
230230 Insulation & Covering – HVAC
230400 Heating Generation Equipment
230450 Refrigeration Equipment – HVAC

230451 Variable Refrigerant Flow Split System Heat Recovery with Simultaneous Heating and Cooling
230500 Piping Systems & Accessories – HVAC
230600 Air Distribution & Accessories – HVAC
230730 Terminal Heating and Cooling Equipment
230760 Air Handling Equipment
230900 Automatic Temperature Controls (DDC)
230950 Testing & Balancing of Mechanical Systems

I. REVISIONS TO DRAWINGS

A. DELETE previously issued drawings in their entirety and INSERT new drawings attached.

END OF ADDENDUM NO. 1

Division 0 - Procurement and Contract Requirements

00 01 01 Project Title Page
00 01 10 Table of Contents
00 01 15 List of Drawings
00 11 13 Advertisement for Bids
00 21 13 Instructions to Bidders
00 41 00 Bid Forms
00 52 00 Agreement Forms
00 61 13 Performance and Payment Bond Forms
00 62 16 Certificate of Insurance
00 72 00 General Conditions
00 73 00 Supplementary General Conditions
00 73 43 Wage Rate Requirements

Division 1 - General Requirements

01 11 00 Summary of Work
01 21 00 Allowances
01 22 00 Unit Prices
01 23 00 Alternates
01 26 00 Change Order Procedures
01 26 13 Contractor Compensation
01 29 00 Payment Procedures
01 31 13 Project Coordination Meetings
01 31 19 Preinstallation Meetings
01 31 25 Web-Based Project Management System
01 32 16 Construction Progress Schedule
01 32 19 Submittals Register
01 32 26 Contractors Daily Reports
01 33 00 Submittal Procedures
01 35 00 Contractor Employee Background Check
01 35 23 Safety Program
01 45 00 Quality Control
01 51 13 Temporary Electricity
01 51 23 Temporary Heating, Cooling, and Ventilating
01 52 00 Construction Facilities & Temporary Controls
01 62 00 Material and Equipment
01 71 23 Field Engineering
01 73 29 Cutting and Patching
01 77 00 Contract Closeout

Division 02 - Existing Conditions

02 4100 Demolition

Division 04 - Masonry
04 2000 Unit Masonry

Division 06 - Wood, Plastics, and Composites
06 1000 Rough Carpentry
06 2000 Finish Carpentry

Division 07 - Thermal and Moisture Protection
07 9005 Joint Sealers

Division 08 - Openings
08 1113 Hollow Metal Doors and Frames
08 4313 Aluminum-Framed Storefronts
08 7102 Door Hardware
08 8000 Glazing

Division 09 - Finishes
09 2116 Gypsum Board Assemblies
09 2300 Gypsum Plastering
09 3000 Tiling
09 5100 Acoustical Ceilings
09 6500 Resilient Flooring
09 9001 Paints and Coatings

Division 10 - Specialties
10 2800 Toilet Accessories

Division 23 - HVAC
230200 General Provisions – HVAC
230210 Basic Materials and Methods – HVAC
230215 Valves
230230 Insulation & Covering – HVAC
230400 Heating Generation Equipment
230450 Refrigeration Equipment – HVAC
230451 Variable Refrigerant Flow Split System Heat Recovery with Simultaneous Heating and Cooling
230500 Piping Systems & Accessories – HVAC
230600 Air Distribution & Accessories – HVAC
230730 Terminal Heating and Cooling Equipment
230760 Air Handling Equipment
230900 Automatic Temperature Controls (DDC)
230950 Testing & Balancing of Mechanical Systems

SECTION 000115 LIST OF DRAWINGS

DRWG NO.	DRAWING NAME	BID PACKS	ISSUE DATE	LATEST REV. DATE
G-001	**Cover Sheet**	**A**	2/16/15	**2/27/15**
A-101	**Basement Plan**	**A**	2/16/15	**2/27/15**
A-102	**First Floor Plan**	**A**	2/16/15	**2/27/15**
A-103	**Second Floor Plan**	**A**	2/16/15	**2/27/15**
~~A-401~~	~~Auditorium – Existing Floor Plan~~	~~A~~	2/16/15	
~~A-402~~	~~Auditorium – New Seating Layout~~	~~A~~	2/16/15	
A-610	**Door Schedule & Details**	**A**	2/16/15	**2/27/15**
M-001	**Legend Sheet Mechanical**	**A**		**2/27/15**
MD-100	**Basement Floor Plan Area A Demolition Mechanical**	**A**		**2/27/15**
MD-101	**Basement Floor Plan Area B Demolition Mechanical**	**A**		**2/27/15**
MD-102	**Basement Floor Plan Areas C & D Demolition Mechanical**	**A**		**2/27/15**
MD-110	**First Floor Plan Area A Demolition Mechanical**	**A**		**2/27/15**
MD-111	**First Floor Plan Areas B Demolition Mechanical**	**A**		**2/27/15**
MD-112	**First Floor Plan Areas C Demolition Mechanical**	**A**		**2/27/15**
MD-120	**Second Floor Plan Area A Demolition Mechanical**	**A**		**2/27/15**
MD-121	**Second Floor Plan Area B Demolition Mechanical**	**A**		**2/27/15**
M-100	**Basement Floor Plan Area A Mechanical**	**A**	2/16/15	**2/27/15**
M-101	**Basement Floor Plan Area B Mechanical**	**A**	2/16/15	**2/27/15**
M-102	**Basement Floor Plan Areas C & D Mechanical**	**A**	2/16/15	**2/27/15**
M-110	**First Floor Plan Area A Mechanical**	**A**	2/16/15	**2/27/15**
M-111	**First Floor Plan Areas B Mechanical**	**A**	2/16/15	**2/27/15**
M-112	**First Floor Plan Areas C Mechanical**	**A**	2/16/15	**2/27/15**
~~**M-113**~~	~~**First Floor Plan Area D Mechanical**~~	~~**A**~~	2/16/15	**2/27/15**
M-120	**Second Floor Plan Area A Mechanical**	**A**	2/16/15	**2/27/15**
M-121	**Second Floor Plan Area B Mechanical**	**A**	2/16/15	**2/27/15**
M-500	**Schedules Mechanical**	**A**	2/16/15	**2/27/15**
M-600	**Schedules & Details Mechanical**	**A**		**2/27/15**
~~PD-101~~	~~Basement Floor Plan Area B Demolition Plumbing~~	~~A~~	2/16/15	
~~P-101~~	~~Basement Floor Plan Area B Plumbing~~	~~A~~	2/16/15	

END OF SECTION

SECTION 001113 ADVERTISEMENT FOR BID

Receipt of Bids

Public notice is hereby given that sealed bids for the following prime contract will be received for the construction of Conrad Schools of Science Door Renovation located at Conrad School of Science, 201 Jackson Avenue, Wilmington, DE 19804. Bids will be received at the Red Clay Consolidated School District Office 1798 Limestone Rd, Wilmington, Delaware 19804 until 2:00 p.m. local time on March 11, 2015, at which time they will be publicly opened and read aloud. ***Bidder bears the risk of late delivery. Any bids received after the stated time will be returned unopened.*** The time and location of the bid opening may be extended with a minimum of 2 calendar days notice to the Bidders.

Contract: A-01 MECHANICAL & CONTROLS

Bidding Document

Documents may be viewed and downloaded at EDiS' FTP site. Bidders requesting the log on information may obtain user name and password permission by contacting Jackie McKee with EDiS Company at jmckee@ediscompany.com or 302-421-2962. Each contractor will be required to provide the following information prior to receiving the log on information: company name, contact name, email address, phone number, fax number and postal mailing address.

It is the responsibility of each bidder to review and coordinate all Project Documents. This includes plans, specifications and addendums. Documents may also be examined at the office of the Construction Manager, EDIS Company, 110 S. Poplar Street, Suite 400, Wilmington, Delaware 19801; the Architect, ABHA Architects, 1621 North Lincoln Street, Wilmington, DE 19806; and the office of Delaware Contractors Association, 527 Christiana Stanton Road, Newark, Delaware 19713.

Bid Security

A bid security in the amount of 10% of the bid including all alternates, plus a consent of surety must accompany each bid. Bid Security shall specify the Owner as the obligee. Owner: Red Clay Consolidated School District, 1502 Spruce Avenue, Wilmington, Delaware 19805.

Pre-Bid Meeting

A pre-bid meeting will be held at the Conrad Schools of Science, 201 Jackson Avenue, Wilmington, DE 19804, on February 24, 2015 at 3:30 PM local time. A site visit will be conducted immediately following the pre-bid meeting..

Questions

Please contact EDiS Company, Mark Grunza at mgrunza@ediscompany.com or 302-421-2956 with questions.

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

Prevailing Wage Rates, as described by Delaware Law, must be adhered to where applicable.

The Red Clay Consolidated School District reserves the right to waive irregularities and to reject any and all bids.

END OF SECTION

SECTION 101100 - SUMMARY OF WORK

1. RELATED DOCUMENTS

1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Sections, apply to work of this Section.

2. CONTRACTS

2.1 The work will be performed under separate prime contracts managed by the Construction Manager.

3. ALTERATIONS & COORDINATION

3.1 Contractor shall be responsible to coordinate their work with the work of others, including, but not limited to, the preparation of general coordination drawings, diagrams and schedules, and control of site utilization, from the beginning of activity, through project close-out and warranty periods.

4. KNOWLEDGE OF CONTRACT REQUIREMENTS

4.1 The Contractor and his Subcontractors, Sub-subcontractors and material men shall consult in detail the Contract Documents for instructions and requirements pertaining to the Work, and at his and their cost, shall provide all labor, materials, equipment and services necessary to furnish, install and complete the work in strict conformance with all provisions thereof.

4.2 The Contractor will be held to have examined the site of the Work prior to submitting his proposal and informed himself, his Subcontractors, Sub-subcontractors and material men of all existing conditions affecting the execution of the Work.

4.3 The Contractor will be held to have examined the Contract Documents and modifications thereto, as they may affect subdivisions of the Work and informed himself, his Subcontractors, Sub-subcontractors and material men of all conditions thereof affecting the execution of the Work.

4.4 The Scope of Work for the Contract is not necessarily limited to the description of each section of the Specifications and the illustrations shown on the Drawings. Include all minor items not expressly indicated in the Contract Documents, or as might be found necessary as a result of field conditions, in order to complete the Work as it is intended, without any gaps between the various subdivisions of work.

4.5 The Contractor will be held to be thoroughly familiar with all conditions affecting labor in the area of the Project including, but not limited to, Unions, incentive pay, procurements,

living, parking and commuting conditions and to have informed his Subcontractors and Sub-subcontractors thereof.

5. CONTRACT DOCUMENTS INFORMATION

5.1 The Contract Documents are prepared in accordance with available information as to existing conditions and locations. If, during construction, conditions are revealed at variance with the Contract Documents, notify the Construction Manager immediately, but no more than three (3) days from the day the variance is first known. Failure to give timely notice shall operate to waive any claim Contractor might otherwise have for an adjustment to Contract Time or Sum as a consequence of such variance.

5.2 The Specifications determine the kinds and methods of installation of the various materials, the Drawings establish the quantities, dimensions and details of materials, the schedules on the Drawings give the location, type and extent of the materials.

5.3 Dimensions given on the Drawings govern scale measurements and large scale drawings govern small scale drawings, except as to anything omitted unless such omission is expressly noted on the large scale drawings.

5.4 The techniques or methods of specifying to record requirements varies throughout text, and may include “prescriptive”, “open generic/descriptive”, “compliance with standards”, “performance”, “proprietary”, or a combination of these. The methods used for specifying one unit of work has no bearing on requirements for another unit of work.

5.5 Whenever a material, article or piece of equipment is referred to in the singular number in the Contract Documents, it shall be the same as referring to it in the plural. As many such materials, articles or pieces of equipment shall be provided as are required to complete the Work.

5.6 Whenever a material, article or piece of equipment is specified by reference to a governmental, trade association of similar standard, it shall comply with the requirements of the latest publication thereof and amendments thereto in effect on the bid date.

5.7 In addition to the requirements of the Contract Documents, Contractor’s work shall also comply with applicable standards of the construction industry and those industry standards are made a part of Contract Documents by reference, as if copied directly into Contract Documents, or as if published copies were bound herein.

5.8 Where compliance with two (2) or more industry standards, contract requirements, or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, then the most stringent requirements, which are generally recognized to be also the most costly, is intended and

will be enforced, unless specifically detailed language written into the Contract Documents clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently equal but different requirements, and uncertainties as to which level of quality is more stringent, to Architect for decision before proceeding.

5.9 Reference standards referenced directly in Contract Documents or by governing regulations have precedence over non-reference standards which are recognized in industry for applicability of work.

5.10 Contractor's bid is based on the complete set of Contract Documents including documents not specifically issued as part of the bid pack but referenced in same.

6. SCOPE OF WORK/GENERAL INFORMATION

6.1 A Scope of Work for each contract to be awarded on the project follows in this section. When a Contract has been awarded to a Contractor, the successful Contractor will be listed after the title of the Contract. When no Contract has yet been awarded, no Contractor's name will be listed. Previous Scopes of Work include addendum changes.

6.2 Contractor is responsible for performing the work listed in the Summary of Work for his contract. Contractor is also responsible for knowing the work that has been assigned to preceding contracts. No additional compensation or extension of time will be allowed a Contractor due to his ignorance of the work assigned to his Contract or to other contracts which may affect his work. The Contractor is responsible, however, for all items which are covered in the Specifications and Drawings relating to their Contract if not specifically mentioned in the Summary of Work.

6.3 The Construction Manager will provide onsite a source for temporary electric, temporary water and portable sanitation facilities only. It is each Contractor's responsibility to make the necessary connections, including all material for temporary electric and water. Please note that utility charges for office trailers will be the responsibility of the individual Contractors.

6.4 A dumpster will be provided on site for free use by Contractors to dispose of non-hazardous, common, work-related refuse. Clean-up is the responsibility of each Contractor. Clean up shall be performed on a daily basis. Contractors not complying will be advised in writing and back charged for all costs associated with the cleanup of their work.

6.5 Contractors are reminded that there are limited storage areas available on site. Offsite storage will be the responsibility of each individual Contractor.

6.6 Office trailer permits off site will be the responsibility of each individual Contractor. On site Contractor's field offices, one (1) per Contractor, if required, will be located as

directed by the Construction Manager.

6.7 Contractor will be prepared to discuss and submit a detailed project schedule seven (7) days after receipt of Notice to Proceed and to begin its submittal process. The Project Schedule is an integral part of this contract. Certain construction sequences and priorities must take place in order to meet the target dates. Concentrated work periods will occur and each Contractor is responsible to staff the project as required by the current Construction Schedule or as directed by the Construction Manager. Contractor will cooperate with the Construction Manager in planning and meeting the required sequences of work and Project Schedule as periodically updated by the Construction Manager.

6.8 All bids must include insurance limits in accordance with Article 11 of the Section 007300 SUPPLEMENTARY CONDITIONS.

6.9 Hoisting, scaffolding and material handling is the responsibility of each Contractor, unless otherwise noted.

6.10 Contractor will be responsible for layout of its own work. The Construction Manager will provide benchmark and layout of the building line.

6.11 Contractor will be responsible to keep clean public roadways soiled by construction traffic on a daily basis. If cleaning is not done, the Construction Manager may perform the cleaning on an overtime basis and back charge the Contractor responsible.

6.12 Contractor Scopes of Work and Schedule are interrelated. Familiarity with each is required.

6.13 The Construction Manager will provide testing services for soil, concrete and steel. Other testing as required by the Contract Documents will be in accordance with the technical specifications and/or the individual scope of work. Refer to Specification Section 004500 - QUALITY CONTROL.

6.14 Safety is the responsibility of each individual Contractor. The project will be governed under the guidelines of OSHA.

6.15 Inter-Contractor shop drawing distribution will be performed by the Construction Manager. Contractor is individually responsible for either coordinating his work with these distributed drawings or notifying the Construction Manager, in writing, of any discrepancies.

6.16 Coordination with other trades will be required. The Contractor will be required to attend periodic coordination meetings with other trades where requirements, conflicts and coordination issues will be discussed and resolved. Attendance when requested will

be mandatory. If inter-Contractor coordination is not satisfactorily performed, the conflicting Contractors shall mutually share the cost to relocate and/or reinstall their work.

6.17 Contractor shall submit a schedule of values to the Construction Manager prior to the submission of their first invoice for approval on AIA G702/CMa, Application for Payment and G703, Continuation Sheet.

6.18 Contractor is expected to review and coordinate its Work with the complete set of Contract Documents, including all items noted as by his trade whether or not shown on that particular set of drawings. Documents are available at the site for review.

6.19 Contractor is responsible for obtaining all necessary permits required for his work, including street permits. Unless otherwise noted, building permit shall be secured by the Construction Manager. Any subcontractor who will be restricting access to street, right of way or adjacent property must notify the Construction Manager 48 hours in advance.

6.20 Contractor's License: Submit a copy of all business licenses required by local and state agencies.

6.21 Contractor shall absorb, without additional compensation, any and all costs of working beyond normal hours to maintain job progress in accordance with the current construction schedule.

6.22 No asbestos or PCB's in or on any material or equipment will be accepted or allowed on this project. All hazardous materials will be treated in accordance with all State and Federal regulations.

6.23 Daily cleanup of the work is the responsibility of each individual Contractor which includes broom cleaning of their debris as required. Contractor will be individually back charged by the Construction Manager for cleanup not satisfactorily performed by the Contractor.

6.24 In the event asbestos is uncovered, the Contractor shall notify the Construction Manager of the areas requiring removal of asbestos. The Construction Manager shall then coordinate the removal with the Owner.

6.25 This project is to be constructed adjacent to and in existing buildings. Contractor shall exercise all due precautions to minimize noise, air pollution and any other construction hazards which in any way would cause discomfort or danger to the occupants of the existing building in the area.

6.26 Existing mechanical, electrical, plumbing, sprinkler, medical gas, fire alarm, etc. systems will be shut off and locked out by the Owner as required by the Work. Tie-in's and

modifications to those systems will be performed by the specific Contractor associated with the work as indicated in the Contract Documents. Re-energizing and re-startup of all systems should be performed by the Owner.

6.27 The Safety Cable System shall not be altered or removed without a written request submitted to the Project Manager with a copy to the Field Manager. It shall be the responsibility of each and every Contractor that is removing or altering the Safety Cable System to maintain the fall protection safety provided by the safety cable and not leave the area unprotected. Each and every Contractor shall be responsible to re-install the Safety Cable System immediately after work is completed. Each and every Contractor shall be responsible to re-install the Safety Cable System in accordance to OSHA standards.

6.28 Normal work hours for this project are from 7:00 a.m. to 3:30 p.m. Any work to be performed outside of these hours must receive prior approval from the Construction Manager. Requests to work beyond normal work hours shall be submitted at least 48 hours prior.

6.29 Contractor is responsible for having a competent project superintendent/foreman on-site during all work performed under its contract.

6.30 In the event the Contractor has non-English speaking employees or subcontractors on the project, they shall have a superintendent or foreman on site, at all times, who speaks English and can communicate with Contractor's employees. Should the Contractor fail to meet this requirement, at any time, Construction Manager may direct all Work to stop until the proper supervision is on site. The Contractor will be responsible for maintaining the project work schedule and make up at its own expense, any delay to the Schedule resulting from the work stoppage.

6.31 Punch List Procedures: Contractor shall be given a copy of the punch list with his appropriate work identified. Contractor shall have nine (9) calendar work days to complete its punch list work. On the 10th day or as determined by the Construction Manager, the Construction Manager shall employ other contractors, as required, to complete any incomplete punch list work and retain from the appropriate Contractors retainage all costs incurred.

6.32 Contractor shall provide the necessary safety barricades and railings required to complete their work and comply with all OSHA, local code and contract specifications.

6.33 **Liquidated Damages:** Contractors are responsible to provide sufficient manpower and equipment and materials to complete work as shown in the project schedule. Any delays in completing a phase of work due to issues caused by a contractor will be subject to a penalty of $1,000 per calendar day that the work is not completed following the scheduled completion date of that phase of work.

CONTRACT NO. A 01 – MECHANICAL & CONTROLS

A. Work included in this contract consists of, but is not necessarily limited to, all labor, materials and equipment for:

- Technical Specification Sections:

Division 0	Bidding and Contract Requirements
Division 1	General Requirements
Section 024100	Demolition
Section 079005	Joint Sealers
Section 230200	General Provisions – HVAC
Section 230210	Basic Materials and Methods – HVAC
Section 230215	Valves
Section 230230	Insulation & Covering - HVAC
Section 230400	Heating Generation Equipment
Section 230450	Refrigerant Piping – HVAC
Section 230451	Variable Refrigerant Flow Split System Heat Recovery With Simultaneous Heating and Cooling
Section 230500	Piping Systems & Accessories – HVAC
Section 230600	Air Distribution and Accessories - HVAC
Section 230730	Terminal Heating and Cooling Equipment
Section 230760	Air Handling Equipment
Section 230900	Automatic Temperature Controls
Section 230950	Testing & Balancing of Mechanical Systems

This contract also includes, but is not necessarily limited to, all labor, materials and equipment for the following:

1. Provide demolition, new units, piping, duct, duct coils, insulation, control valves, valves, accessories and replacement of all mechanical systems as indicated on Drawings and Specifications.

2. Provide all equipment, connections, dual temperature piping connections balancing and ATC for all equipment as noted on the floor plans, equipment schedule and details.

3. Provide all necessary design labor and quick-ship costs to supply Unit Ventilators, Roof Top Units, Energy Recovery Unit, heat pumps, Fin tube & condensing Units for installation in areas for installation on or prior to dates identified in the project schedule.

4. Division 26 of the specifications should be reviewed as it relates to the power wiring and other requirements for HVAC equipment including the coordination of furnishing and installing motor starters as provided in the specifications.

5. This Contractor shall be responsible to designate an individual within his organization, intimately familiar with this project and assigned on site, to act as the System Start-up Coordinator. This individual must be pre-approved by the Construction Manager. This individual's responsibilities shall include, but not be limited to, coordinating the start-up of all mechanical equipment, including the coordination between the Electrical Contractor, the Controls Contractor, and all testing, adjusting and balancing work. This individual shall report on a weekly basis, in written form, to the Construction Manager. These reports shall include a summary of current conditions including manufacturers' start-ups, systems' deficiencies noted to date and the remediation of same, coordination issues between trades, system interfacing and forecasting, as necessary to project the completion of each individual system within the building.

6. Provide the removal of existing and installation of all equipment bases and housekeeping pads as indicated. Include removal of debris to this contractor's supplied dumpster. CM Will not provide any dumpsters for demolition debris. Note: There is a frost curb detail for some units. Provide as directed.

7. Provide permitting and inspections as required.

8. Provide penetrations through wall, floors, etc. including cutting, patching and fire safing. Patching is to provide smoke/seal through walls and floors.

9. Provide extended warranties for equipment and accessories as indicated.

10. Provide testing, adjusting and balancing for all mechanical systems as specified. Include water and air balancing. Provide signed and sealed test report by a certified engineer. Report is due prior to New Castle county final inspection.

11. Provide daily fine cleanup of the work is the responsibility of each individual Contractor which includes broom cleaning of their debris as required. Daily Fine clean up on a daily basis shall be defined as those means/methods utilized to perform the daily cleaning tasks without producing dust, noise and stacking of stored materials. All debris must be removed from the building at the end of each work day.

12. All guarantees and warranties to begin at the substantial completion of the entire project. Maintain equipment prior to substantial completion.

13. Provide all lifts, hoisting, rigging and scaffolding to complete scope of work.

14. Provide, coordinated design, supply, and installation of automatic temperature controls. This contractor is responsible for coordination and installation of ATC system as specified under this section.

15. Provide all ductwork, flex duct, grilles and diffusers and all associated supports, hangars and bracing. Any blocking associated with the curbs or bracing shall be provided by this contractor. For blocking installations, reference section 06200.

16. Provide adjustments to louvers and vents related to HVAC operations. Provide new louvers where needed or indicated.

17. Coordinate damper size, location and type of damper with architectural drawings.

18. Temporary heat and ventilation installation, maintenance and removal. Refer to Division 1, Specification section 015123 - TEMPORARY HEAT AND VENTILATION, for specific scope.

19. Provide roof curbs and include all costs associated with roof patching, flashings and counter flashings and any temporary roof enclosure needed to perform this work to ensure water tight openings at all times. Any blocking associated shall be provided by this contractor. For blocking installations, reference section 06200.

20. Provide access panels as required.

21. Provide as-built drawings.

22. Provide coordination with the owner's existing ATC system for equipment and materials being provided under their contract. Include all costs for delivery and receipt at curbside.

23. This contractor is responsible to accept delivery and/or provide storage of all equipment and then transportation to curb side of job site and provide installation of all systems. No additional costs for multiple deliveries in order to maintain sequence will be provided.

24. Provide all piping connections from D Mark locations where indicated. All acoustical ceilings will need to be removed, stored, protected and reinstalled by this contractor on an as needed basis to access the tie-in locations as indicated. Any tiles damaged or found to be unsuitable shall be replaced by this contractor at no additional costs to the project.

25. Provide all work associated Demolition Notes and/or General Notes on Mechanical drawings as indicated.

26. Reutilize all outside air louvers. This includes removal, storage and reinstallation. Provide additional insulation as needed to eliminate potential of freezing piping/coils.

27. Provide wall sleeve to connect outdoor air opening on unit ventilator to outdoor grilles.

28. Remove and reinstall piping enclosures (horizontal and vertical) to provide removal, reinstallation of piping, power & controls. If additional piping enclosures are required, this contractor shall provide as indicated on M-600 – Unit Ventilator Piping Enclosure Detail. This contractor must coordinate with Electrical contractor that will be awarded in Bid Pac "B".

29. Provide all soldering, welding and brazing as required, where required.

30. Remove and replace thermostats, wire/conduits as indicated. Provide capping/safe off and patching as required. Provide cover plates if indicated.

31. Remove existing heat pumps completely where indicated. "Remove" shall include, but not be limited to refrigerant piping and controls, all piping as indicated from unit to condensing unit outside. Include patching as required.

32. The existing boilers are to remain. This contractor shall provide the removal and replacement of the power flame gas burner in its entirety. This shall include the disconnect and capping of gas piping and controls and providing of new gas burner assembly, tying in to gas piping and new controls. Contractor shall pay particular attention to specifications for measurements and data provided.

33. Remove existing DX Coils in air handling equipment where indicated. This shall include all piping from condensing unit to coil. Include removal/storage and reinstallation of ceiling tiles and patching and capping.

34. Where the removal of exterior heat pumps is indicated, this contractor shall be aware that some of these areas are enclosed in fenced in areas. The removal or cutting of fencing is prohibited. Any damage to fencing will be replaced by this contractor at no additional cost to the project.

35. Provide removal of heat pump including all refrigerant piping controls in Room 221-A. Removal shall consist of the unit, piping and controls from unit to condensing unit outside. Include removal/storage and reinstallation of ceiling tiles and patching and capping.

36. ACC #1 and all rooftop equipment or components must have specified equipment support rails and/or pipe supports, flashings and counter flashings provided by this contractor. Any blocking associated with the curbs or bracing shall be provided by this contractor. For blocking installations, reference section 06200.

37. Provide drip pans where specified.

38. Provide all factory startup of equipment as specified.

39. Provide additional attic stock/replacement filters as specified.

40. Perform all demolition and disposal of all existing units and associated connections to a dumpster provided by this contractor. No construction dumpsters will be provided by th Construction Manager for the removal of any demolished materials or associated piping, ductwork or miscellaneous components.

41. Provide labeling, valve charts and tagging as indicated. Provide scaled drawings with locations in metal framed & acrylic cover as indicated.

42. Provide protection of adjacent floors and finishes during demolition of mechanical and plumbing fixtures, equipment, pipe, etc. Protection shall consist of 20 mill poly layered under taped Masonite for access in all areas affected.

43. Provide an allowance to install two (2) 6″ valves and four (4) 1 1/2″ valves on the piping mains to the classrooms in the event that existing valves do not hold. Any allowance costs not utilized will be returned to owner at end of project if not utilized.

44. Domestic plumbing will be issued in Bid Pac "B". No costs associated with domestic piping shall be included in base bid.

45. All work commenced during a shift must be completed at the end of each shift or safed-off. No work can be left incomplete or unsafe to protect student/staff from use or interaction. This includes, but is not limited to, completion of installation, removal of all debris, material and equipment in each area and the removal of any unsafe conditions created by the installation each shift. Any additional labor or materials extending beyond normal working hours will be done so at own risk. No additional compensation will be provided for work not completed as scheduled, on a daily basis.

46. Drawing A-102, Sheet notes #1, #2 & #4 shall be disregarded as these items will be completed by others. This work will be bid out in Bid Pac "B". Sheet note #3, "Remove existing ACT and retain for reinstallation. Coordinate locations with MEP drawings" shall be the responsibility of this contractor. Further clarifying Note #3, this contractor shall complete the removal, storage and replacement of ceiling tiles/grid as needed to perform mechanical tie-ins. This contractor shall provide clean gloves during the relocation and reinstallation of ACT so that no damage or staining of tiles occur. If ceiling tile/grid is damaged during the removal or reinstallation, this contractor shall provide new, matching ceiling tiles in kind, at no additional cost to the project.

47. Drawing A-103 Sheet note #1-#3 shall be disregarded as these items will be completed by

others. This work will be bid out in Bid Pac "B". Sheet note #4 Area of mechanical abatement, provide patch and repair as required at existing roof during the demolition and installation of equipment is the responsibility of this contractor. This contractor shall provide any temporary measures required in order to guarantee watertight enclosure throughout removal, reinstallation and start up at location.

48. Provide training for all systems as specified.

49. Provide blank plates where indicated.

50. Provide wall sleeve to connect outdoor air openings at unit ventilators to outdoor grilles.

51. Include all associated provisions with the understanding that this project includes liquidated damages of $1,000 a day for every day not completed per construction schedule.

52. Provide a $10,000 allowance to be used at the discretion of the Construction Manager.

END OF SECTION

SECTION 013500 – CONTRACTOR EMPLOYEE BACKGROUND CHECK

1. It is the contractor's responsibility to perform background checks and screen all employees working onsite. The background check must include checking for a previous history of Child Abuse Convictions, Child Molestation Convictions, Felony Convictions, and Drug Convictions within the last 5 years. Any employee with any of these convictions may not enter the job site or school campus. This background check must be completed and screened by the contractor prior to an employee entering the job site. The Construction Manager, The Owner's representative and the Owner have the right to request that the screening data be submitted on a case by case basis.

2. The contractor is required to provide the Construction Manager written notice verifying background checks were completed and screened by the contractor prior to an employee entering the job site. This notice will contain the individual's name and the last four digits of their social security numbers. Notices must be received no later than two (2) working days before access is required. Notices will be forwarded electronically to the Construction Manager. A sample notice follows this section for your reference.

END OF SECTION

Date

Mr. Mark Grunza
Project Manager
EDiS Company
110 South Poplar Street
Wilmington, DE 19805

RE: Conrad Schools of Science - Certification of Background Checks

Dear Mr. Grunza:

This letter is to certify that background checks have been completed in accordance with Section 013500 Contractor Employee Background Check. The following individuals are certified as having met the requirements of the specification:

Name	Last 4 SSN
Mr. John Smith	1234

If you require any additional information you may contact INSERT POINT OF CONTACT, PHONE NUMBER AND EMAIL ADDRESS.

Sincerely,

Company

NAME
TITLE
MCS/jr (author's initials in CAPS/typist's initials in lowercase)

PROJECT MANUAL

FOR

CONRAD SCHOOL OF SCIENCE RENOVATIONS

RED CLAY CONSOLIDATED SCHOOL DISTRICT — **OWNER**
1502 SPRUCE AVENUE
WILMINGTON, DELAWARE 19805

ABHA ARCHITECTS — **ARCHITECTS**
1621 N. LINCOLN STREET
WILMINGTON, DELAWARE 19806
(302) 658-6426, FAX (302) 658-8431

LARSEN & LANDIS — **STRUCTURAL ENGINEERS**
1615 SUNSET LANE
WILMINGTON, DE 19810
(302) 475-3175

FURLOW ASSOCIATES — **MECHANICAL/ELECTRICAL AND PLUMBING ENGINEERS**
1206 SOCIETY DRIVE
CLAYMONT, DE 19703
(302) 798-3515, FAX (302) 798-9799

ABHA PROJECT NUMBER: 1426

DATE: FEBRUARY 13, 2015

ADDENDUM NO. 1: FEBRUARY 27, 2015

ABHA architects
1621 N. Lincoln Street
Wilmington, DE 19806
(P)302.658.6426
(F)302.658.8431
abhagen@ABHA.com
www.ABHA.com

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SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. 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 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

D. 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.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove portions of existing building as shown and noted on the Drawings.

B. Remove other items indicated, for salvage, relocation, and recycling.

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. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. 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.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   8. Do not close or obstruct roadways or sidewalks without permit.
   9. 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.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. 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.

E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 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 shown.
   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. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 .

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, and Electrical): 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.

3.05 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. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Concrete Block.

C. Ceramic Glazed Structural Clay Facing Tile.

D. Mortar and Grout.

E. Reinforcement and Anchorage.

F. Flashings.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.

B. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a.

D. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units; 2012.

E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2012.

I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

J. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

K. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale); 2012.

1.04 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. Shop Drawings: For the following:
   1. Pre-Faced CMU's: Show sizes, colors, coursing, and locations of special colors.
   2. Embedded Masonry Flashing: showing location of each course in wall section and plan view of each course with all details and stop ends referenced.

1.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories and structural backup in mock-up.

B. Locate where directed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
   2. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
   3. Special Shapes: Provide non-standard blocks configured for corners.
      a. Provide bullnose blocks at exposed corners.
      b. Provide square edge blocks for corners scheduled to receive tile or other finishes.
   4. Load-Bearing Units: ASTM C90, normal weight.

2.02 DECORATIVE CONCRETE MASONRY UNITS

A. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for exposed outside corners, including door jambs and other openings in masonry partitions, unless otherwise indicated.

C. Ground-Face CMUs: ASTM C 90.
   1. Basis of Design Product: Subject to compliance with requirements, provide Fizzano Brothers; ground face block or comparable product by one of the following:
      a. Betco Supreme
   2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
   3. Size (Width): Manufactured to the following dimensions:
      a. 6 inches nominal; 5-5/8 inches actual.
   4. Pattern and Texture:
      a. Pattern, ground-face finish on opposite faces.
   5. Color: To be selected

2.03 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Color and texture: Match existing with new or salvaged bricks.

2. Actual size: Match existing.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

2.04 CLAY TILE UNITS

A. Manufacturers:
1. Elgin Butler Company: www.elginbutler.com.
2. Substitutions: See section 01 6000 - Product requirements.

B. Ceramic Glazed Structural Clay Facing Tile: ASTM C126; Grade S (Select); Type I (single-faced units).
1. Color and texture: Custom mottled finish to match existing.
2. Size: 6T Series, thickness as indicated.
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping to produce equivalent effect.

2.05 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91, Not Permitted.

B. Portland Cement: ASTM C150, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

2.06 REINFORCEMENT AND ANCHORAGE

A. Single Wythe Joint Reinforcement: Truss type; ASTM A 82/A 82M steel wire, mill galvanized to ASTM A 641/A 641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

2.07 FLASHINGS

A. Copper/Kraft Paper Flashings: 5 oz/sq ft sheet copper bonded to fiber reinforced asphalt treated Kraft paper.
1. Manufacturers:
a. Hohmann & Barnard, Inc; C-Kraft Duplex: www.h-b.com.

B. Shelf Angles & Lintels: Flashing must be carried through the wall to prevent water from bypassing flashing.

C. Shelf Angle Soft Joints: Flashing Membrane or Drip must be compatible with wet sealant. Provide letter from flashing manufacturer addressing sealant compatibility.

D. Lap Sealant: Butyl type as specified in Section 07 9005.

2.08 ACCESSORIES

A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell neoprene; oversized 50 percent to joint width; self expanding; 3.5 inch wide x by maximum lengths available.
1. Manufacturers:
a. Williams Products, Inc.; Product Type NN1, 1040 Series.
b. Substitutions: See Section 01 6000 - Product Requirements.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Panels designed for installation at flashing locations.
      a. Manufacturers:
         1) Advanced Building Products Inc: www.advancedflashing.com.
         2) Mortar Net USA, Ltd: www.mortarnet.com.

D. Weeps: Open Head Joints.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.09 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.01 COURSING

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave, except at masonry to receive spray foam provide flush joints fully filled with mortar and mortar droppings removed from ties.

C. Brick Units:
   1. Bond: Running.

D. Clay Tile Units:

3.02 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.03 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 of exterior face of masonry.

3.04 CONTROL AND EXPANSION JOINTS

A. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.05 CUTTING AND FITTING

A. Cut and fit for chases, pipes, and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.06 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.07 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Fire retardant treated wood materials.

C. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.

D. PS 1 - Structural Plywood; 2009.

E. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology, Department of Commerce; 2010.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood; see Section 01 6000 for requirements.

D. Provide wood harvested within a 500 mile radius of the project site.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:
   1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Provide the following specific non-structural framing and blocking:
   1. Grab bars.
   2. Towel and bath accessories.

3.03 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.

3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Hanging doors, installing hardware.

C. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ANSI A208.1 - American National Standard for Particleboard; 2009.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2009.

E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

2.02 DOORS AND HARWARE

A. Refer to Section 08 1113 Hollow Metal Doors and Frames for information.

B. Refer to Section 08 1613 Fiberglass Doors for information.

C. Refer to Section 08 7102 Hardware for information.

2.03 WOOD TREATMENT

A. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Install doors and frames as scheduled.

C. Install hardware as scheduled.

3.02 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Sealants and joint backing.

C. Precompressed foam sealers.

1.02 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2010.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

D. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Type 1 - General Purpose Exterior Sealant: Silicone; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Color: To be selected by Architect from manufacturer's full range.
   2. Joint Movement Range: +/- 50 percent. (minimum)
   3. Product:
      a. SilPruf NB SCS9000 manufactured by Momentive Performance Materials, Inc (formerly GE Silicones).
      b. 890FTS manufactured by Pecora Corporation.
      c. 890FTS TXTR manufactured by Pecora Corporation.
      d. 795 manufactured by Dow Corning.
   4. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between metal frames and other materials.

C. Type 2 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Colors as selected.
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.

D. Type 3 - Coal tar extended, fuel resistant polyurethane sealant: Not Used.

E. Type 4 - Fire Resistant Foam Sealant:
   1. Manufacturers:
      a. Dow Corning: Product: 3-6548 RTV Foam.

F. Type 5 - NOT USED

G. Type 6 - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
   1. Applications: Use for:
      a. Joints between plumbing fixtures and floor and wall surfaces.
      b. Joints between kitchen and bath countertops and wall surfaces.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Fire Rated Joint Filler: Pre-engineered, patened, flexible, textile fiberglass roll material with a fiberglass matt facing, containing approximately 30 percent by weight unexpanded vermiculite; Ultra Block manufactured by Backer Rod Manufacturing, Inc.

E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve the following:
   1. Width/depth ratio of 2:1.
      a. Minumim joint depth: 3/16 inch; Maximum joint depth: 1/2 inch, unless otherwise required by manufacturer.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

D. Install backer rod using blunt or rounded tool to a uniform (+/- 1/8 inch) depth without puncturing the material.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

3.06 SCHEDULE

A. Exterior Joints for Which No Other Sealant Type is Indicated: Type 1; colors as selected.

B. Interior Joints for Which No Other Sealant is Indicated: Type 2; color as selected.

C. Penetrations of Fire Rated Construction: Type 1 with Ultra Block joint filler or Type 4.

D. Joints Between Plumbing Fixtures and Walls and Floors, and Between Countertops and Walls: Type 6.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Non-fire-rated steel doors and frames.

C. Fire-rated steel doors and frames.

D. Thermally insulated steel doors.

1.02 ALTERNATES

A. Refer to Scope of Information Sheets for description of work under this Section affected by alternates.

1.03 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003 (R2008).

D. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2011).

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

F. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

G. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).

I. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

K. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

L. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 **MANUFACTURERS**

A. Steel Doors and Frames:
1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
2. De La Fontaine Inc; Hollow Metal Door Model _____: www.delafontaine.com.
3. De La Fontaine Inc; Windstorm-Resistant Steel Door and Frame; door style ____: www.delafontaine.com.
4. De La Fontaine Inc; Hollow Metal Frame ____ Profile: www.delafontaine.com.
5. Republic Doors: www.republicdoor.com.
6. Steelcraft, an Allegion brand: www.allegion.com/us.
7. Technical Glass Products; SteelBuilt Window & Door Systems: www.tgpamerica.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
1. Accessibility: Comply with ICC A117.1 and ADA Standards.
2. Door Top Closures: Flush with top of faces and edges.
3. Door Edge Profile: Beveled on both edges.
4. Door Texture: Smooth faces.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
7. Galvanizing for Units in Wet Areas: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness
8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Exterior Doors:
1. Grade: ANSI A250.8 - SDI-100; Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 2 - Seamless.
2. Core: Polystyrene.
3. Thickness: 1-3/4 inch.
4. Top Closures for Outswinging Doors: Flush with top of faces and edges.

5. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
6. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.
7. Weatherstripping: Separate, see Section 08 7100.

B. Interior Doors, Non-Fire-Rated:
1. Grade: ANSI A250.8 - SDI-100; Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 2 - Seamless.
2. Core: Kraftpaper honeycomb.
3. Thickness: 1-3/4 inch.

C. Interior Doors, Fire-Rated:
1. Grade: ANSI A250.8 - SDI-100; Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 2 - Seamless.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
   a. Rate of Temperature Rise Across Door Thickness : 250 degrees F.
   b. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
   c. Attach fire rating label to each fire rated unit.
3. Core: Mineral board.
4. Thickness: 1-3/4 inch.

2.04 STEEL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door, except:
   a. ANSI A250.8 - SDI-100, Level 2 and 3 Door Frames: 14 gage, 0.067 inch, minimum thickness.
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
6. Provide kerfed stops for inserted weatherstripping.

B. Exterior Door Frames: Fully welded.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
2. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire-Rated: Knock-down type

D. Interior Door Frames, Fire-Rated: Knockdown type.
1. Fire Rating: Same as door, labeled.

2.05 ACCESSORY MATERIALS

A. Glazing: As specified in Section 08 8000, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, butted corners; prepared for countersink style tamper proof screws.

C. Astragals for Double Doors: Specified in Section 08 7100.
1. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.

D. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

E. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

F. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Coordinate installation of hardware.

F. Coordinate installation of glazing.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Test sound control doors for force to close, latch, and unlatch; adjust as required to comply.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

B. New frames in existing openings shall be knock-down type.

C. New frames in new openings shall be fully welded type.

END OF SECTION

SECTION 08 4313

ALUMINUM-FRAMED STOREFRONTS

PART 2 PRODUCTS

1.01 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulated glazing.
   2. Glazing Position: Centered (front to back).
   3. Vertical Mullion Dimensions: 2 x 4.5 inches.
   4. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   7. 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.
   8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   11. Basis of Design: Subject to compliance with requirements, provide Kawneer North America; TRIFAB 451 or comparable product by one of the following:
      a. Other Acceptable Manufacturers:
         1) YKK AP America Inc.
         2) United States Aluminum Corp.

1.02 FABRICATION

END OF SECTION

SECTION 08 7102
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. 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.

C. Where items of hardware are not specified and are required for intended service, such omission, error or other discrepancy shall be submitted to Architect fourteen calendar days prior to bid date for clarification by addendum.

D. Products supplied but not installed under this Section:
   1. Hardware for aluminum doors will be furnished under this Section, but installed under Division 08 00 00 Openings
   2. Final replacement of cylinder cores to be installed by Owner.

E. Refer to Division 1 for alternates that may affect work of this Section.

F. Related Divisions:
   1. Division 08 00 00 Openings
   2. Division 26 00 00 Electrical

1.02 REFERENCES

A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):
   1. ANSI/BHMA A156.1 Butts & Hinges (2006)
   2. ANSI/BHMA A156.2 Bored & Preassembled Locks & Latches (2003)
   3. ANSI/BHMA A156.3 Exit Devices (2008)
   4. ANSI/BHMA A156.4 Door Controls - Closers (2008)
   5. ANSI/BHMA A156.5 Auxiliary Locks (2010)
   6. ANSI/BHMA A156.6 Architectural Door Trim (2010)
   7. ANSI/BHMA A156.7 Template Hinge Dimensions (2009)
   8. ANSI/BHMA A156.8 Door Controls - Overhead Stops and Holders (2010)
   9. ANSI/BHMA A156.15 Closer Holder Release Devices (2006)
   10. ANSI/BHMA A156.16 Auxiliary Hardware (2008)
   11. ANSI/BHMA A156.18 Materials & Finishes (2006)
   12. ANSI/BHMA A156.21 Thresholds (2009)
   13. ANSI/BHMA A156.22 Door Gasketing Systems (2005)
   14. ANSI/BHMA A156.26 Continuous Hinges (2006)
   15. ANSI/BHMA A156.28 Keying Systems (2007)
   16. ANSI/BHMA A156.29 Exit Locks and Alarms (2007)
   17. ANSI/BHMA A156.30 High Security Cylinders (2003)
   18. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames (2006)
   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 (2003)

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 (2008)
2. NFPA 80 Standard for Fire Doors and Other Opening Protective's (2007)
3. NFPA 101 Life Safety Code (2012)
4. NFPA 105 Standard for the Installation of Smoke Door Assemblies (2007)

F. Building Codes
1. IBC International Building Code (2012)
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. Hardware schedule shall be 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. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.
3. 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:
1. Distribute door hardware templates to related divisions within fourteen calendar days of approved hardware schedule.

E. Closeout Submittals: Submit to Owner in a three ring 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. Hardware supplier name, phone number and fax number.

1.04 QUALITY ASSURANCE

A. 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.

B. Door hardware shall conform to ICC/ANSI A117.1.
   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.

C. 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 labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.

D. 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.

E. Door hardware shall be certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.

F. Substitution request: Refer to Division 1Substitutions for procedures to submit products meeting the requirements in this Section.

G. Pre-installation Meeting: Comply with requirements in Division 1 Section “Project Meetings.”
   1. Convene meeting seven days before installation. Participants required to attend:
      a. Contractor, installer, material supplier, manufacturer representatives.
   2. Include in conference decisions regarding proper installation methods and procedures for receiving and handling hardware.
   3. Review and finalize construction schedule and verify availability of materials, installer’s personnel, equipment and facilities needed to make progress and avoid delays.

H. 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.

I. Installer Qualifications: Specialized in performing installation of this Section and shall have five years minimum documented experience.

J. Hardware listed in 3.07- Hardware Schedule is intended to establish a type and grade.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide a 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 keys, cores 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
   1. 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 shall 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. Contractor, hardware supplier, and hardware installer shall be responsible for servicing hardware and keying related problems.
   1. Ten years for manual door closers.
   2. Five years for mortise, auxiliary and bored locks.
   3. Five years for exit devices.
   4. Two years for electromechanical door hardware.

C. Products judged defective during warranty period shall be replaced or repaired 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.

PART 2 - PRODUCTS

2.01 HINGES

A. Hinges, continuous hinges shall be 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
   3. Self-Closing Hinges: ANSI/BHMA 156.17
   4. Continuous Hinges: ANSI/BHMA A156.26

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 shall 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. Provide mortar boxes for frames that require any electrically modified hinges if not an integral part of frame.
e. When shims are necessary to correct frame or door irregularities, provide metal shims only.

5. Acceptable Manufactures:

	Standard Weight	Heavy Weight
a. Hager	BB1279/BB1191	BB1168/BB1199
b. Bommer	BB5000/BB5002	BB5004/BB5006
c. McKinney	TA2714/TA2314	T4A3786/T4A3386

2.02 CONTINUOUS HINGES

A. Continuous hinges shall be 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. 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. Standard weight hinges shall have a minimum spacing between bearings of 5-1/8". Typical door from 80" to 84" in height to have a minimum of 16 bearings.
c. Heavy Weight 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. Hinges shall have Rounded Back Cover Channel (RBCC).
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. 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 Manufactures:

	Heavy Duty
1. Hager Companies	780-224HD 780-210HD

2. Bommer FM120HD
3. Zero 914A

2.03 FLUSH BOLTS AND COORDINATORS

A. Flushbolts shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following:
1. 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 Manufactures:

	Manual Flush Bolt	Auto Flush Bolt	Dust Proof Strike	
1.	Hager Companies	282D	291D/292D/295W/295M	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 Manufactures:

	Coordinator	Bracket	Bracket for stops greater than 2-1/4”	
1.	Hager Companies	297D	297M	297N
2.	Rockwood	1600	1601AB	1601C
3.	Trimco	3094	3095	3096

2.04 LOCKS AND LATCHES (GRADE 1 CYLINDRICAL)

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

B. Standards: Product to be certified and listed by following:
1. ANSI/BHMA A156.2 Series 4000 Certified to Grade 1.
2. ANSI/BHMA A250.13 Certified for a minimum design load of 1150lbf (100psf) for single out swinging doors measuring 36” in width and 84” in height and a minimum design load of 1150lbf (70psf) for out swinging single doors measuring 48” in width and 84” in height.
3. UL/cUL Labeled and listed for functions up to 3 hours for single doors up to 48” in width and up to 96” in height.
4. UL10C/UBC 7-2 Positive Pressure Rated.
5. 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 and Latch chassis to be Zinc dichromate for corrosion resistance.
2. Keyed functions to be of a freewheeling design to help resists against vandalism.
3. Non-handed, field reversible.
4. Thru-bolt mounting with no exposed screws.
5. Levers shall be Zinc cast and plated to match finish designation in hardware sets.

6. Roses shall be of solid Brass or Stainless Steel material.

E. Latch and Strike:
1. Stainless Steel latch bolt with minimum of ½" throw and deadlocking for keyed and exterior functions. Provide ¾" latchbolt for pairs of fire rated doors. Standard backset to be 2-3/4" and faceplate shall be adjustable to accommodate a square edge door or a standard 1/8" beveled edge door.
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.

F. Acceptable Manufactures:
1. Schlage: ND Series - Everest - no equal

2.05 DEADBOLTS (GRADE 1)

A. Deadbolts shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:
1. Auxiliary Locks: ANSI/BHMA A156.5 Grade 1
2. UL/cUL listed for functions up to 3 hours for "A" label
3. UL10C/UBC 7-2 Positive Pressure Rated

C. Deadbolt function numbers and descriptions of manufactures series as listed in hardware sets.

D. Material and Design:
1. Latch bolt 1"throw, material brass with concealed harden steel roller to prevent sawing or cutting.
2. Freewheeling collar design to help resists against vandalism.
3. Non-handed, field reversible.

E. Acceptable Manufactures:
1. Hager Companies: 3830S Series.
2. Schlage:
3. Sargent:

2.06 EXIT DEVICES (GRADE 1)

A. Shall be touch pad type, finish to match balance of door hardware. Exit Devices shall be of one manufacturer as listed for continuity of design and consideration of warranty.

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 305Listed 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 Manufactures:
   1. Hager Companies: 4500 Series
   2. Von Duprin: 98 Series
   3. Sargent: 80 Series

2.07 CYLINDERS AND KEYING

A. Cylinders shall be 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. Schlage Everest cores for interior and Primus for exterior.
   2. Shall be furnished with cams/tailpieces as required for locking device that is being furnished for project.

D. Keying:
   1. 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.
   2. Copy of Owners approved keying schedule shall be 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 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 manufactures:
   1. Schlage - no equal

2.08 PUSH/PULL PLATES AND BARS

A. Push and pull plates shall be 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.
   1. Acceptable Manufactures:
      a. Hager Companies: 30S
      b. Rockwood
      c. Trimco

D. Pull plates: .050" thick, square corner and beveled edges. Width and height as stated in hardware sets, ¾" diameter pull, with clearance of 2-1/2" from face of door.
   1. Acceptable Manufactures:
      a. Hager Companies: H33
      b. Rockwood
      c. Trimco

E. Push Pull Bar Sets: 1" round bar stock with 2 ½" clearances from face of door. Offset to be 3", 90-degree standard. Center to center size should be door width less 1 stile width.
   1. Acceptable Manufacturers:
      a. Hager Companies: H160D
      b. Rockwood
      c. Trimco

F. Back-to-Back pulls for Pocket/Barn Doors: 3" clearance from face of door
   1. Acceptable Manufactures:
      a. Hager Companies: H20L
      b. Rockwood: RM301
      c. Trimco: 1195-3J

2.09 CLOSERS (CAST IRON BODY GRADE 1)

A. Shall be product of one manufacturer. 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 shall have surface parallel arm mount closers except where noted on hardware schedule.
   2. In swing doors shall have 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 shall have 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 manufactures:
   1. Hager Companies: 5100 Series
   2. LCN: 4040 Series
   3. Sargent: 281 Series

2.10 PROTECTIVE TRIM

A. 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
   2. Mop Plates 4” high.

B. Standards: Manufacturer shall meet requirements for:
   1. Architectural Door Trim: ANSI/BHMA A156.6
   2. UL

C. Material and Design:
   1. 0.050” gage stainless steel
   2. Corners shall be square. Polishing lines or dominant direction of surface pattern shall run across the door width of plate.
   3. Bevel top, bottom and sides uniformly leaving no sharp edges. Edges shall be de-burred.
   4. Countersink holes for screws. Screws holes shall be spaced equidistant eight inches CTC, along a centerline not over ½ inch in from edge around plate. End screws shall be a maximum of 0.53 inch from corners.

D. 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.

E. Acceptable Manufactures:
   1. Hager Companies: 194S
   2. Rockwood: K1050
   3. Burns: KP50, MP50

2.11 STOPS AND HOLDERS

A. 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 shall have stainless steel machine screws and lead expansion shields.

B. Standards: Manufacturer shall meet requirements for:
   1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufactures:

	Convex	Concave	Floor	
1.	Hager Companies	230W	234W	242F
2.	Rockwood	402	403	441H
3.	Burns	560	565	521

D. 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.

E. Standards: Manufacturer shall be certified by the following:
   1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1

F. Acceptable Manufactures:

	Heavy Duty Surface	Heavy Duty Concealed
1. Hager Companies	7000-S	7000-C
2. Rixson	9 Series	6 Series
3. Glynn Johnson	90 Series	100 Series

2.12 DOOR GASKETING AND WEATHERSTRIP

A. Provide continuous weatherstrip 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.

B. Standards: Manufacturer shall meet requirements for:
   1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22

C. 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.

D. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.

2.13 THRESHOLDS

A. 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.

B. Standards: Manufacturer to be certified by the following:
   1. Thresholds: ANSI/BHMA A156.21
   2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Acceptable Manufactures:
   1. National Guard Products: 896
   2. Hager Companies: 412S and 413S
   3. Zero
   4. Reese

2.14 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 Manufactures:

	Hollow Metal Frame	Wood Frame
1. Hager Companies:	307D	308D
2. Rockwood:	608	609

3. Trimco:

2.15 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 SETS

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

HEADING 1

Door #001E, 002E

Each opening to receive:

QTY		TYPE	DESCRIPTION	FINISH
6	ea.	Hinge	5BB1HW NRP	US32D
2	ea.	Exit Device	98L-NL 06	US26D
2	ea.	Trim	996L	US26D
2	ea.	Cylinder	Schlage Primus	US26D
1	ea.	Removable Mullion	9954	PTD
2	ea.	Closer	4040 XP	ALM
2	ea.	Kick Plate	8400 10" x 2" LDW	US32D
2	ea.	Gasket	5050	Charcoal
1	ea.	Threshold	896	ALM

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Glass.

C. Glazing compounds and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

1.04 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

A. Type IG-1 - Sealed Insulating Glass Units: Vision glass, double glazed.
   1. Application: All exterior glazing unless otherwise indicated.
   2. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
      b. Coating: Low-E (passive type), on #2 surface.
   3. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   4. Total Thickness: 1 inch.
   5. Glazing Method: Gasket glazing.

2.02 GLAZING UNITS

A. Type A - Single Vision Glazing:
   1. Type: Fully tempered float glass.
   2. Tint: Clear.
   3. Thickness: 1/4 inch.

2.03 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.
   2. Guardian Industries Corp: www.sunguardglass.com.
   3. Pilkington North America Inc: www.pilkington.com/na.
   4. PPG Industries, Inc: www.ppgideascapes.com.
   5. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Glass Type 1: Float Glass: All glazing is to be float glass unless otherwise indicated.

1. Fully Tempered Types: ASTM C1048.
2. Thickness: 1/4 inch.

C. Glass Type 2: Fire-Protection-Rated Glazing:
1. IBC Fire Protection Rating: D-H-45 or OH-45 or W-60, minimum.
2. Provide products listed by Underwriters Laboratories or Intertek Warnock Hersey.
   a. Substitutions: Refer to Section 01 6000 - Product Requirements.
3. Products:
   a. SCHOTT North America Inc; Pyran Platinum L (laminated) Fire Rated Ceramic Glass.
   b. Vetrotech Saint-Gobain North America; .

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Glazing Tape: Preformed butyl compound ; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
1. Manufacturers:
   a. Pecora Corporation: www.pecora.com.
   b. Tremco Global Sealants: www.tremcosealants.com.
   c. Substitutions: Refer to Section 01 6000 - Product Requirements.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; black color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with manufacturer's instructions.

3.03 GLAZING METHODS

3.04 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.06 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Performance criteria for gypsum board assemblies.

C. Metal stud wall framing.

D. Metal channel ceiling panel framing.

E. Gypsum wallboard.

F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 51 00 - Acoustical Ceilings: Acoustically Reflective Ceiling Panels

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2012.

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2013.

C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.

D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

E. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007 (Reapproved 2013).

G. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2010a.

H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

I. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2014.

J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

K. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2013.

L. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; 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 all stud framing products that do not comply with ASTM C645 or 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 application and finishing.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. 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 Fire Resistance Directory. Refer to Drawings for UL Assembly Reference Numbers.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Marino: www.marinoware.com.
   3. Phillips Manufacturing Company: www.phillipsmfg.com.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/360 at 7.5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
   2. Studs: "C" shaped with flat or formed webs 20 gage minimum.
   3. Runners: U shaped, sized to match studs.
   4. Ceiling Channels: C shaped.
   5. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging both sides.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com.
   3. Lafarge North America Inc: www.lafargenorthamerica.com.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. USG Corporation: www.usg.com.
   6. Substitutions: See Section 01 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.
      b. Ceilings: 5/8 inch.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C 1629.
   1. Application: High-traffic areas indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
   4. Type: Fire-resistance rated Type X, UL or WH listed.
   5. Thickness: 5/8 inch
   6. Edges: Tapered.
   7. Products:
      a. National Gypsum Company; Gold Bond Hi-Impact Brand XP Wallboard.
      b. Temple-Inland Inc; ComfortGuard IR Impact Resistant.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, or rigid plastic, unless otherwise indicated.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional cornerbead and control joints, provide L-bead at exposed panel edges.

B. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and cornersin wet areas.
   2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Chemical hardening type compound.

C. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

D. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

E. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs as indicated.
   1. Extend partition framing to structure in typical conditions, 6 inches above ceiling at perimeter wall conditions and as indicated.
   2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

3.03 **BOARD INSTALLATION**

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: 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.

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 2300
GYPSUM PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Gypsum plaster over gypsum lath, metal lath, concrete, and other solid surfaces.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data on plaster materials, characteristics, and limitations of products specified.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.04 FIELD CONDITIONS

A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F or over 80 degrees F.

B. Maintain minimum ambient temperature of 50 degrees F during and after installation of plaster.

PART 2 PRODUCTS

2.01 PLASTER MATERIALS

A. Ready-Mixed Gypsum Plaster: ASTM C28/C28M; mill-mixed type, requiring only the addition of water.

B. Bonding Agent: ASTM C631; type recommended for bonding plaster to concrete and concrete block surfaces.

2.02 METAL LATH

A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.

2.03 PLASTER MIXES

A. Over Other Solid Bases: Two-coat application, ready-mixed plaster, mixed and proportioned in accordance with ASTM C842 and manufacturer's instructions.

B. Over Metal Lath: Three-coat application, ready-mixed plaster, mixed and proportioned in accordance with ASTM C842 and manufacturer's instructions.

C. Ready-Mixed Plaster Materials: Mix in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing conditions are satisfactory before starting work.

B. Concrete: Verify surfaces are flat, honeycomb is filled flush, and surface is ready to receive work of this section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster or plaster bond.

C. Grounds and Blocking: Verify items within walls for other sections of work have been installed.

D. Gypsum Lath and Accessories: Verify substrate is flat and surface is ready to receive work of this section. Verify joint and surface perimeter accessories are in place.

E. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

3.02 PREPARATION

A. Dampen masonry surfaces to reduce excessive suction.

B. Clean concrete surfaces of foreign matter. Thoroughly dampen surfaces before using acid solutions, solvent, or detergents to perform cleaning. Wash surface with clean water.

C. Roughen smooth concrete surfaces and smooth faced masonry.

D. Apply bonding agent in accordance with manufacturer's instructions.

3.03 INSTALLATION - GYPSUM LATH AND ACCESSORIES

A. Install gypsum lath in accordance with ASTM C841.

B. Install gypsum lath perpendicular to framing members, with lath face exposed. Stagger end joint of alternate courses. Butt joints tight. Maximum gap allowed: 1/8 inch.

C. Place corner reinforcement diagonally over gypsum lath and across corner immediately above and below openings. Secure to gypsum lath only.

D. Continuously reinforce internal angles with corner mesh, return 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.

E. Place corner bead at external wall corners; fasten at outer edges of lath only.

F. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

G. Place 4 inch wide strips of strip mesh centered over junctions of dissimilar backing materials. Secure rigidly in place.

H. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.

3.04 PLASTERING

A. Apply gypsum plaster in accordance with ASTM C842 and manufacturer's instructions.

B. Thickness of Plaster including Finish Coat:
   1. Match existing adjacent plaster thickness.
   2. Over gypsum lath: 1/2 inch.
   3. Finish coat applied direct to concrete: 3/16 inch, maximum.

C. Finish Texture: Float to a consistent finish.
   1. Match adjacent plaster finish.

3.05 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Tile for floor applications.

C. Tile for wall applications.

D. Solid surface thresholds.

E. Trim.

1.02 RELATED REQUIREMENTS

A. Section 07 9005 - Joint Sealers.

B. Section 09 05 61 - Common Work Results for Flooring Preparation

C. 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 - Version; 2013.1.

B. ANSI A108.1A - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2013.1.

C. 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; 2013.1.

D. 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 Mortar; 2013.1.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2013.1.

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 2013.1.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 2013.1.

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 2013.1.

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2013.1.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2013.1.

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2013.1.

L. ANSI A108.12 - American National Standard Specifications for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 2013.1.

M. ANSI A108.13 - American National Standard Specifications for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2013.1.

N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2013.1.

O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2013.1.

P. ANSI A137.1 - American National Standard Specifications for Ceramic Tile - Version; 2013.1.

Q. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation - Version; 2013.1.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 24 x24 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

F. LEED Submittal: Documentation of recycled content and location of manufacture.

1.05 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.

B. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. Dal-Tile Corporation: www.daltile.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Paver and Wall Tile : ANSI A137.1, and as follows:
   1. Continental Slate manufactured by Daltile or approved equivalent product.
   2. Size and Shape: 18 x 18 inch for floor installation.
   3. Thickness: 5/16 inch
   4. Face: Plain.
   5. Surface Finish: Unglazed.

6. Floor Pattern: As shown.
7. Color(s): As scheduled.
8. Trim Units: Matching bullnose and cove base shapes in sizes coordinated with field tile.

2.02 TRIM AND ACCESSORIES

A. Trim: Porcelian, style and dimensions to match field tile, for setting using tile mortar or adhesive.
   1. Applications: Use in the following locations:
      a. Open edges of wall tile: Bullnose
      b. Wall corners, inside: Jointed.
      c. Floor to wall joints: Cove base.
   2. Manufacturer: Same as field tile.

B. Thresholds: Solid surface material, color as scheduled, honed finish; 4 inches wide by full width of wall or frame opening; 3/4 inch thick; profile as detailed with radiused corners on top side; without holes, cracks, or open seams
   1. Material: So;lid surface: Grade B or C.
   2. Applications: Provide at the following locations:
      a. At doorways where tile terminates.
      b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Application(s): Use this type of bond coat where indicated and where no other type of bond coat is indicated.
   2. Products:
      a. Custom Building Products; MegaLite: www.custombuildingproducts.com.
      b. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com.
      c. Merkrete, by Parex USA, Inc; Merkrete 720 Marble Pro: www.merkrete.com.
      d. ProSpec, an Oldcastle brand; Permalastic System: www.prospec.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 MORTAR MATERIALS

A. Mortar Bond Coat Materials for Thin-Set Installations:
   1. Latex-Portland Cement type: ANSI A118.4.

2.05 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 wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.

B. Grout Sealant: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
   1. Products:
      a. Bonsal, W. R., Company; 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."

2.06 MEDIUM-BED MATERIALS

A. Cementitious self-leveling underlayment:
1. Polymer-modified, self-leveling Portland cement-based underlayment.
2. Product: Ardex TL 1000 manufactured by ARDEX Americas, 400 Ardex Park Drive, Aliquippa, Pennsylvania 15001
3. Primer: Ardex P51.
4. Cementitious bond coat: ANSI A118.6 or better.
5. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
a. Thickness: 20 mils, maximum.
b. Crack Resistance: No failure at 1/16 inch gap, minimum.
c. Providing compliance with performance requirements and manufacturer's installation requirements, the following trowel applied crack prevention membrane is approved:
1) RedGard Waterproofing and Crack Prevention Membrane manufactured by Custom Building Products.
2) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com.
3) Merkrete, by Parex USA, Inc.; Merkrete Fracture Guard 5000: www.merkrete.com.

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.

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.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. 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. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

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.

K. 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 The Tile Council of North America Handbook Method F205A, Above-ground Concrete with cementitious Self-leveling underlayment and Ceramic Tile grout, unless otherwise indicated.

1. Use uncoupling membrane under all tile unless other underlayment is indicated.

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 grout 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.

3.07 PROTECTION, CLEANING AND GROUT SEALING

A. Do not permit traffic over finished floor surface for 4 days after installation.

B. Apply to clean, completed tile walls and floors a protective coat of neutral cleaner solution, 1 part cleaner to 1 part water.

C. Cover tile floors with heavy-duty, non-staining construction paper, masked in place.

D. Prior to final acceptance of tile work, remove paper and rinse protective coat of neutral cleaner from all the surfaces.

E. Clean tile and grout surfaces.

F. Apply grout sealant according to manufacturer's directions.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Suspended metal grid ceiling system.

C. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635/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; 2008e1.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG: www.usg.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustical Panels Type ACP-1: Painted mineral fiber, ASTM E1264, Type IV with the following characteristics:
   1. Size: 24 x 24 inches.
   2. Thickness: 3/4 inches.
   3. Composition: Wet felted.
   4. NRC Range: 0.70 as specified in ASTM E1264.
   5. Ceiling Attenuation Class (CAC): ____, determined in accordance with ASTM E1264.
   6. Edge: Square.
   7. Surface Color: White.
   8. Surface Pattern: Non-directional fissured.
   9. Products:
   10. Suspension System: Exposed grid Type 1 (White).

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. USG: www.usg.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. 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.

C. Exposed Steel Suspension System Type 2: Formed G90 hot-dipped galvanized steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.
   3. Finish: White painted.
   4. Product: Prelude Plus XL by Armstrong.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 9005.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.02 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Resilient tile flooring.

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, 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 F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2010)e1.

D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012)e1.

E. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; 2002.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

G. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

H. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com.

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; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two samples, 12 x 12 inch 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.

1.05 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness, and:
   1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648.
   3. Size: 12 x 12 inch.
   4. VOC Content: Certified as Low Emission by one of the following :
      a. SCS Floorscore; www.scscertified.com.
   5. Thickness: 0.125 inch.
   6. Pattern: Mottled.
   7. Manufacturers:
      a. Armstrong World Industries, Inc; Product Standard Excelon: www.armstrong.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
   1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648.
   2. Height: 4 inch.
   3. Thickness: 0.125 inch thick.
   4. Finish: Satin.
   5. Length: Roll.
   6. Color: Color as selected from manufacturer's standards.
   7. Manufacturers:
      a. Johnsonite, a Tarkett Company: www.johnsonite.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.
   1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.

C. Moldings, Transition and Edge Strips: manufactured by Johnsonite, Inc.

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. 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. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is cured.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints 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.

3.04 TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

C. Install tile to monolithic pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 9001
PAINTS AND COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Surfaces to be finished are indicated in this section and on the Drawings.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 5000 - Metal Fabrications: Shop-primed items.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Master Painters and Decorators Association; 2004.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system (copy of relevant MPI Manual page is acceptable).

C. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

D. Samples: Submit one paper "drop" samples, 8-1/2 by 11 inches in size, illustrating colors selected for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

B. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide wall panel, 8 feet long by 10 feet wide, illustrating coating color, texture, and finish.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.09 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Supply 1 gallon of each color; store where directed.

C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

B. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

C. Paints: Acceptable manufacturers are limited to the following:
   1. Benjamin Moore & Co: www.benjaminmoore.com.
   2. Sherwin-Williams: www.sherwin-williams.com.
   3. Glidden Professional: www.gliddenprofessional.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Nonflat: 150 g/L, maximum.
         3) Opaque, High Gloss: 250 g/L, maximum.

4) Varnishes: 350 g/L, maximum.
c. Architectural coatings VOC limits of State in which the project is located.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Paints and Coatings: Provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI Categories, except as otherwise indicated.
1. Provide ready mixed paints and coatings .
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 PAINT SYSTEMS

A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.

B. Provide colors as directed by Architect.
1. Allow for minimum of five colors for each system, unless otherwise indicated, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.04 EXTERIOR PAINT SYSTEMS

A. SYSTEM E-1:
1. Substrate: Structural Steel and Metal Fabrications:
2. Applications include but are not limited to miscellaneous metal boxes and covers.
3. Manufacturers and products:
a. Sherwin Williams:
1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8 Series
3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8 Series
b. Benjamin Moore:
1) 1st Coat: Moore PO6 Super Spec HP Alkyd Metal Primer
2) 2nd Coat: 096 MoorGlo Acrylic Semi-Gloss House Paint
3) 3rd Coat: 096 MoorGlo Acrylic Semi-Gloss House Paint
c. Glidden Professional:
1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
2) 2nd Coat: Glidden Professional Fortis 450 6407 topcoat
3) 3rd Coat: Glidden Professional Fortis 450 6407 topcoat

B. SYSTEM E-2:
1. Substrate: Galvanized Metal, Not Chromate Passivated:
2. Applications include but are not limited to doors and frames, lintels and bollards.
3. Manufacturers and Products:
a. Sherwin Williams:
1) 1st Coat:S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
2) 2nd Coat:S-W DTM Acrylic Coating, Semi-Gloss, B66-200 Series
3) 3rd Coat:S-W DTM Acrylic Coating, Semi-Gloss, B66-200 Series
b. Benjamin Moore:
1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
2) 2nd Coat:Moore N096 MoorGlo Acrylic Semi-Gloss House Paint

3) 3rd Coat:Moore N096 MoorGlo Acrylic Semi-Gloss House Paint

c. Glidden Professional:

1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
2) 2nd Coat: Glidden Professional Fortis 450 6407 topcoat
3) 3rd Coat: Glidden Professional Fortis 450 6407 topcoat

2.05 INTERIOR PAINT SYSTEMS

A. SYSTEM I-1:

1. Substrate: Concrete Masonry Units
2. Manufacturers and Products:

a. Sherwin Williams:

1) 1st Coat:S-W PrepRite® Block Filler, B25W25
2) 2nd Coat:S-W ProMar® 200 Latex Flat
3) 3rd Coat:S-W ProMar® 200 Latex Flat

b. Benjamin Moore:

1) 1st Coat:Moore 160 Super Spec Latex Block Filler
2) 2nd Coat:333 Regal AquaGlo Acrylic Flat Enamel
3) 3rd Coat:333 Regal AquaGlo Acrylic Flat Enamel

c. Glidden Professional:

1) 1st Coat:Glidden Professional Block Filler 3010 primer
2) 2nd Coat:Glidden Professional Diamond 450 Flat
3) 3rd Coat:Glidden Professional Diamond 450 Flat

B. SYSTEM I-2

1. Substrate: Concrete Masonry Units (Epoxy paint, Semi-gloss finish)
2. Manufacturers and Products:

a. Sherwin Williams:

1) 1st Coat:S-W Heavy Duty Block Filler, B42W46
2) 2nd Coat:S-W Pro Industrial HB/ Waterbased Epoxy, B71W111/B71W100 Series
3) 3rd Coat:S-W Pro Industrial HB/ Waterbased Epoxy, B71W111/B71W100 Series

b. Benjamin Moore:

1) 1st Coat: Super Spec HP Waterborne Epoxy Block Filler P31
2) 2nd Coat:Super Spec HP Acrylic Epoxy Coating P43
3) 3rd Coat:Super Spec HP Acrylic Epoxy Coating P43

c. Glidden Professional:

1) 1st Coat:Tru-Glaze 4015 Block Filler
2) 2nd Coat:Tru-Glaze WB 4426 Water-Based Epoxy
3) 3rd Coat:Tru-Glaze WB 4426 Water-Based Epoxy

C. SYSTEM I-3

1. Substrate: Structural Steel and Metal Fabrications:
2. FInish: Semi-Gloss.
3. Manufacturers and Products:

a. Sherwin Williams:

1) 1st Coat:S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
2) 2nd Coat: S-W ProMar® 200 Latex Flat
3) 3rd Coat:S-W ProMar® 200 Latex Flat

b. Benjamin Moore:

1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
2) 2nd Coat:N333 Regal AquaGlo Acrylic Flat Enamel

3) 3rd Coat: N333 Regal AquaGlo Acrylic Flat Enamel

c. Glidden Professional:

1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
2) 2nd Coat:Glidden Professional Diamond 450 Flat
3) 3rd Coat:Glidden Professional Diamond 450 Flat

D. SYSTEM I-4

1. Substrate: Hollow metal door frames:
2. Finish: Gloss.
3. Manufacturers and Products:

a. Sherwin Williams:

1) 1st Coat: DTM Acrylic Primer/Finish, B66W1
2) 2nd Coat:DTM Acrylic Gloss Coating, B66W100
3) 3rd Coat: DTM Acrylic Gloss Coating, B66W100

b. Benjamin Moore:

1) 1st Coat: Moorcraft Super Spec DTM Alkyd Satin, Z163
2) 2nd Coat:Moorcraft Super Spec Urethane Gloss Enamel, Z22
3) 3rd Coat: Moorcraft Super Spec Urethane Gloss Enamel, Z22

c. Glidden Professional:

1) 1st Coat: DEVGUARD 4360 Low VOC Universal Primer
2) 2nd Coat:DEVGUARD 4309 Rust Preventative Gloss Enamel
3) 3rd Coat: DEVGUARD 4309 Rust Preventative Gloss Enamel

E. SYSTEM I-5

1. Substrate: Galvanized Metal, Not Chromate Passivated:
2. Applications include but are not limited to doors, frames, railings, and exposed ductwork.
3. Manufacturers and Products:

a. Sherwin WIlliams:

1) 1st Coat:S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
2) 2nd Coat:S-W ProMar® 200 Latex Flat
3) 3rd Coat:S-W ProMar® 200 Latex Flat

b. Benjamin Moore:

1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
2) 2nd Coat:N333 Regal AquaGlo Acrylic Flat Enamel
3) 3rd Coat:N333 Regal AquaGlo Acrylic Flat Enamel

c. Glidden Professional:

1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
2) 2nd Coat:Glidden Professional Diamond 450 Flat
3) 3rd Coat:Glidden Professional Diamond 450 Flat

F. SYSTEM I-7 - NOT USED

G. SYSTEM I-8 - NOT USED

H. SYSTEM I-9

1. Substrate: Gypsum Board (Satin Finish):
2. Applications include but are not limited to walls, ceilings, soffits, and bulkheads.
3. Manufacturers and Products:

a. Sherwin Williams:

1) 1st Coat:S-W PrepRite 200 Int. Latex Primer, B28 Series
2) 2nd Coat:S-W ProMar® 200 Latex Eggshell, B20Series
3) 3rd Coat:S-W ProMar® 200 Latex Semi-Gloss, B31Series

b. Benjamin Moore:
   1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
   2) 2nd Coat:N319 Regal Acrylic Latex Eggshell Finish Enamel
   3) 3rd Coat:N319 Regal Acrylic Latex Eggshell Finish Enamel
c. Glidden Professional:
   1) 1st Coat: Glidden Professional High Hide 1000 primer
   2) 2nd Coat:Glidden Professional Diamond 450 7300 topcoat
   3) 3rd Coat:Glidden Professional Diamond 450 7300 topcoat

I. SYSTEM I-11
   1. Substrate: Concrete Floor (Sealed):
   2. Manufacturers and Products:
      a. W. R. Meadows:
         1) 1st Coat:CS-309/30 Concrete Curing and Sealing Compound

PART 3 EXECUTION

3.01 SCOPE -- SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:
   1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
   2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
   3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
   4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
   5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
   6. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.
   7. Paint shop-primed mechanical and electrical items occurring in finished areas.
   8. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   9. Paint interior surfaces of air ducts and convector and baseboard heating cabinets with flat, nonspecular black paint where visible through registers, grilles, or louvers.
   10. Paint dampers exposed behind louvers, grilles, to match face panels.
   11. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

C. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
   2. Items indicated to receive other finish.
   3. Items indicated to remain naturally finished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Anodized aluminum.

6. Polished and brushed stainless steel items.
7. Brick, precast concrete, integrally colored plaster.
8. Polished and brushed stainless steel, anodized aluminum, bronze, terne, and lead.
9. Acoustical materials.
10. Concealed piping, ductwork, and conduit.

3.02 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Architect's approval.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Board: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

E. Measure the ph factor of concrete, masonry, and mortar before starting any finishing process, using the method specified in MPI Architectural Painting Manual.
   1. Report results in writing to Architect before starting work.
   2. If results of test indicates need for remedial action, provide written description of remedial action. If a different primer or paint systems is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from Architect.

3.03 PREPARATION

A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
   1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
   2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

L. Interior Wood Items to Receive Transparent Finish: Sand wood to obtain a uniform appearance before immediately starting work. Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.
   1. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
   1. Number of coats and film thickness required are the same regardless of application method.
   2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
   3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
   1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
   2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
   3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.

4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
7. Pigmented (Opaque) Finishes: Provide smooth, opaque surface of uniform finish, color, appearance, and coverage.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.06 CLEANING AND PROTECTION

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

END OF SECTION

SECTION 10 2800
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 10 00, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Accessories for toilet rooms.

C. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 10 2113.19 - Solid Composite Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2014e1.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

E. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products listed are made by Bobrick and Bradley Corporation.

B. Other Acceptable Manufacturers:
   1. A & J Washroom Accessories Inc: www.ajwashroom.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Substitutions: Section 01 6000 - Product Requirements.

C. All items of each type to be made by the same manufacturer.

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. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Adhesive: Two component epoxy type, waterproof.

G. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.

H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

2.04 TOILET ROOM ACCESSORIES

A. Toilet Paper Dispenser: Jumbo Roll Dispenser
   1. Product: San-Jamar Model No. R4000TBK.

B. Not Used

C. Paper Towel Dispenser: Folded paper type, Black Pearl ABS cover, surface-mounted, .
   1. Product: T1490TBK manufactured by San-Jamar.

D. Not Used

E. Waste Receptacle:
   1. Product: Floor Type, Model # 3546 manufactured by Rubbermaid.

F. Soap Dispenser: Soap dispenser, wall-mounted, surface, with black ABS cover .
   1. Product: #S890TBK manufactured by San-Jamar.

G. Mirrors: Stainless steel framed, 6 mm thick laminated glass mirror.
   1. Series B- 290 manufactured by Bobrick.
   2. Size: 18 x 30 inches and 24 x 60 inches, as shown.
   3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.

H. Grab Bars: Stainless steel, 1-1/2 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
   1. Length and configuration: As indicated on drawings.
   2. Product: B-6806 Series manufactured by Bobrick.

I. Not Used

J. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Product: B-254 manufactured by Bobrick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

D. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

END OF SECTION

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: 23 0200 thru 23 0950.

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. Make or arrange for utility connections and pay all charges. (Designer Choice)

D. 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

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. Develop overall coordination drawing (all trades) and submit for review prior to fabrication/installation.

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. Submit a 1/4" scale layout of all mechanical equipment rooms. All equipment and pads shall be to scale of equipment being furnished. Obtain size information of any and all equipment from other trades and indicate on drawings. The drawings shall be fully coordinated with all trades prior to submission. Indicate coil pull areas, filter pull areas, maintenance clearances, and access as applicable.

4. 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.
5. Resubmit revised or additional shop drawings as requested.
6. 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.
7. 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.
8. 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.
9. 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.

E. Where only one brand name or manufacturer is identified, no substitutions are permitted.

F. Substitutions:

1. Until a date no later than seven (7) days before the date Bids are due, Architect will consider written requests from bidders for substitution of Products. Architect will review requests and will notify Bidders in an Addendum if the requested substitution is acceptable.

2. Submit a separate request for each Product, supported with complete data, with drawings and samples as appropriate, including:

   a. Comparison of the qualities of the proposed substitution with that specified.

   b. Changes required in other elements of the work because of the substitution.

   c. Effect on the construction schedule.

   d. Cost data comparing the proposed substitution with the Product specified.

   e. Any required license fees or royalties.

   f. Availability of maintenance service, and source of replacement materials.

3. Architect shall be the judge of the acceptability of the proposed substitution.

4. A request for a substitution constitutes a representation that Bidder:

   a. Has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified.

   b. Will provide the same warranties or bonds for the substitution as for the Product specified.

   c. Will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects.

   d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

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 Construction Manager 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 Construction Manager.

D. Perform field mechanical balancing in accordance with Section 23 0950: 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. Contractor to demonstrate all systems to Engineer for verification of operation prior to Owner's instruction period.

2. Provide two (2) 4-hour sessions of training to School District 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:

- Air handlers
- Energy recovery unit
- D/X cooling units
- Burners
- Unit ventilators/fan coil 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 CONCRETE

A. Concrete shall be in accordance with Section 03300.

2.4 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. Seal sleeves for pipes or conduit 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.

3.6 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 Construction Manager 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. All Mechanical Rooms shall be identified with a permanent placard of red-white-red laminated, commercial grade, plastic construction. Letters shall be minimum one inch high and read in capital letters: WARNING – MECHANICAL EQUIPMENT ROOM – LIMITED ACCESS. Placard shall be

centered on each door leading into the mechanical room at five feet above the floor and attached at each corner with brass screws.

E. Refrigeration Machinery Rooms shall be identified with a permanent placard of red-white-red laminated, commercial grade, plastic construction. Letters shall be minimum one inch high for the header to read in capital letters: WARNING – REFRIGERATION EQUIPMENT ROOM – LIMITED ACCESS. The following information shall be posted in a similar fashion, minimum half-inch high capital letters, indicating:

1. The name and address of the installer.
2. The refrigerant number and amount of refrigerant in pounds.
3. The lubricant identity and amount in pounds or ounces as appropriate.
4. The field test pressure applied to the equipment in psig.

Placard shall be centered on each door leading into the refrigeration equipment room at five feet above the floor and attached at each corner with brass screws.

F. 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 Construction Manager 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 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.

E. Contractor to include an 11 month “walk-thru” of the building systems 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, etc. prior to the expiration of the guarantee period.

3.16 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.

3.17 TESTING AND BALANCING OF MECHANICAL EQUIPMENT

A. Perform field mechanical balancing in accordance with Section 23 0950: 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 23 0200 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. Polyvinyl Chloride (PVC) Pipe and Fittings
4. Strainers
5. Test Stations - Pressure/Temperature
6. Isolating Fittings
7. Pipe Saddles
8. Unions
9. Motors

1.3 REFERENCE STANDARDS

A. Refer to Section 23 0200 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 seamless, 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.
4. Fittings: ASME B16.15, B16.18, B16.22, or B16.26.

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 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Pipe:

1. ASTM D-1785 Schedule 40, Type 1, Grade 1
2. ASTM D-2665 (DWV) drain, waste and vent.

B. Fittings:

1. ASTM D-2466 Schedule 40.
2. ASTM D-2665 DWV.

C. Solvent Cement: ASTM D-2564 Schedule 40 and DWV.

D. Uniformity: To insure installation uniformity, all piping components shall be of one manufacturer.

E. Flux shall be non-toxic type and non-corrosive.

2.4 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.

2.5 TEST STATIONS – PRESSURE/TEMPERATURE

A. Provide a SISCO 1/4" or 1/2" NPT fitting (Test Plug) of solid brass at desired indicated locations. Test plug shall be capable of receiving either a pressure or temperature probe 1/8" o.d. Dual seal core shall be neoprene for temperature to 200 degrees F. Nordel to 350 degrees F and shall be rated zero leakage from vacuum to 1000 psig. P/T plug to have grooved cap and chain.

B. P/T plugs shall be provided with extensions as required by insulation.

C. Mechanical Contractor shall also provide the following: pressure gauge adapters with 1/8" o.d. probe, 5" stem pocket testing thermometers for 25° to 125° F (tower and chilled water) for 0° to 220° F (hot water) for 50° - 500° F (temperatures above 220° F).

D. One (1) Master Test Kit shall be furnished to the Owners. Kit shall contain one (1) 2-1/2" test gauge of suitable range, one (1) Gauge Adapter 1/8" o.d. probe, and 5" stem pocket testing thermometers - one (1) 0° - 220° F and one (1) 50° - 550° F.

E. Manufacturer: Sisco P/T Plugs.

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: Epco 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 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.

2.9 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.

Nominal Efficiencies for "NEMA Premium ™" Induction Motors Rated 600 Volts or Less (Random Wound)						
	Open Drip-Proof			**Totally Enclosed Fan-Cooled**		
HP	**3500 RPM**	**1800 RPM**	**1200 RPM**	**3500 RPM**	**1800 RPM**	**1200 RPM**
1	**82.5**	**85.5**	**77.0**	**82.5**	**85.5**	**77.0**
1.5	**86.5**	**86.5**	**84.0**	**87.5**	**86.5**	**84.0**
2	**87.5**	**86.5**	**85.5**	**88.5**	**86.5**	**85.5**
3	**88.5**	**89.5**	**85.5**	**89.5**	**89.5**	**86.5**
5	**89.5**	**89.5**	**86.5**	**89.5**	**89.5**	**88.5**
7.5	**90.2**	**91.0**	**88.5**	**91.0**	**91.7**	**89.5**
10	**91.7**	**91.7**	**89.5**	**91.0**	**91.7**	**90.2**
15	**91.7**	**93.0**	**90.2**	**91.7**	**92.4**	**91.0**
20	**92.4**	**93.0**	**91.0**	**91.7**	**93.0**	**91.0**
25	**93.0**	**93.6**	**91.7**	**93.0**	**93.6**	**91.7**
30	**93.6**	**94.1**	**91.7**	**93.0**	**93.6**	**91.7**
40	**94.1**	**94.1**	**92.4**	**94.1**	**94.1**	**92.4**
50	**94.1**	**94.5**	**93.0**	**94.1**	**94.5**	**93.0**
60	**94.5**	**95.0**	**93.6**	**94.5**	**95.0**	**93.6**
75	**94.5**	**95.0**	**93.6**	**94.5**	**95.4**	**93.6**
100	**95.0**	**95.4**	**93.6**	**95.0**	**95.4**	**93.6**

Nominal Efficiencies for "NEMA Premium ™" Induction Motors Rated 600 Volts or Less (Random Wound)						
	Open Drip-Proof			Totally Enclosed Fan-Cooled		
HP	3500 RPM	1800 RPM	1200 RPM	3500 RPM	1800 RPM	1200 RPM
125	95.4	95.4	94.1	95.0	95.4	94.1
150	95.4	95.8	94.1	95.8	95.8	95.0
200	95.4	95.8	94.1	95.8	96.2	95.0

G. Motor Characteristics: Refer to Equipment Schedules for specific data.

120/208 Volt System: Motors 1/2HP & Larger - 208V, 3 Phase, 3 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.

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. Make-up Water: Type L hard copper.
2. Dual Temperature Water Supply & Return Piping:
   a. Schedule 40 black steel.
   b. Type L hard copper.
   c. Grooved End black steel.
3. AC Condensate Drain (including pumped condensate):
   a. Type DWV copper.
   b. Schedule 40 PVC.
4. 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. Secure to wall in **Mechanical** Room.
3. 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.	Gas	- Yellow	- Black
2.	Dual Temperature Water Supply	- Yellow	- Black
3.	Dual Temperature Water Return	- Yellow	- Black
4.	Refrigerant Liquid	- Yellow	- Black
5.	Refrigerant Gas	- Yellow	- Black
6.	Cold Water Make-up	- Green	- White
7.	Pumped Condensate	- Yellow	- Black

E. Provide color coded 1" diameter markers on ceiling tile grids to indicate system and valve locations.

Dual Temperature 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. Air conditioning condensate drain piping
   2. Dual temperature water piping
   3. Cold water fill and make-up 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 23 0200 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. Dual Temp Water Heating System
3. Refrigerant Valves and 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 DUAL TEMP 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 T580-70BR	S580-70BR-R
Inline 334	----

Drain valves, ½” or ¾”, 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, 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

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

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

For Class 200 Service, threaded ends:

Stockham B-345

Hammond IB949

Nibco T453-BY

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 ends, and swing-type disc.

Recommended valves:

Stockham G-931

Hammond IR1124

Nibco F918-B

2.4 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: Steel shell, ceramic fired desiccant core, solder connections, UL listed, 500 psi working pressure.

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 23 0210.

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 23 0200 for HVAC General Provisions

C. Refer to Section 23 0210 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. Condensate Drain Lines
2. Dual temperature water piping.
3. Refrigerant Piping.
4. Reusable Valve Covers
5. 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 23 0200 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 0210 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 23 0200.

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, 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.

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 w/25% compression shall be 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 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.

2.4 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
8 – 18	5.0	18	12	16
20 – 30	5.0	24	18	14

I. Manufacturer: Tru-Balance insulated saddles as made by Buckaroos, 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:

3. Cold Water Make-Up: 1" for piping 2" and below.

6. Dual Temperature Water:

1-1/2” for piping 1-1/2” and below.

2" for piping 2" and larger.

7. 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.)

1-1/2" thick.

Option: 1-1/2” thick flexible closed cell insulation.

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.)

1-1/2" thick.

2. Cold surfaces of refrigeration equipment, air separators for chilled and heating hot water, and chilled water pumps. 3/4" thickness

3. Hot and chilled water expansion tanks. 3/4" thickness

4. 1” thickness for all water piping within terminal unit cabinets.

   1” thickness for dual temperature piping 1-1/2” and below.

5. ½” 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 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 0400

HEATING GENERATION EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Work Included:

1. Furnish all heat generation equipment as specified herein and with capacities as scheduled on the drawings.
2. Furnish Two (2) Power Flame natural gas fired burner to regulate, fire, and control the existing Weil McLain Series 2494 boilers at this facility.

1.2 QUALITY ASSURANCE:

A. References:

The publications and standards listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
ANSI	American National Standards Institute
FM	Factory Mutual Engineering, Division Associated Factory Mutual Fire Insurance Companies
IRI	Industrial Risk Insurers
IBR	Institute of Boiler and Radiator Manufacturers
UL	Underwriters' Laboratories, Inc.
AGA	American Gas Association
NEMA	National Electrical Manufacturers Association
NEC	National Electrical Code of National Fire Protection Association.

B. Quality Control:

1. All heating generation equipment shall be new and limited to products regularly produced and recommend for service ratings in accordance with engineering data or other comprehensive literature made available and in effect at time of bidding. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.
2. Qualifications: The system hardware manufacturers as listed and as supplied by Bradley-Sciocchetti, Inc. are intended to provide standard of quality which is acceptable. Substitutions shall be acceptable, if a bidding contractor formally submit to the engineer detailed data on at least ten systems, of equal complexity, which the proposed system supplier has designed and serviced over the past five years. The system supplier shall have been incorporated on a full time basis in the design, supplying, and servicing of such systems of a minimum of 20 years. This data must be formally presented in writing ten days prior to bid opening, at which time the client will evaluate same. If acceptable, a bulletin will be

issued informing all bidding contractors of same. Only bidding contractor can submit for substitutions. Vendors, manufacturers or non-bidding contractors will not be acceptable.

1.3 SUBMITTALS:

A. Submit in accordance with requirements in Conditions of Contract. Shop drawings shall be complete in all respects and shall include manufacturer's certified drawings showing all dimensions, installation methods, size, weight, capacity, ratings, integral controls, types of materials, elevations and section, and indicating compliance with applicable codes and regulations meeting all requirements.

B. Literature:

Manufacturer's latest publication.

1.4 PRODUCT DELIVERY, HANDLING AND STORAGE:

A. Product Handling:

Deliver all materials in good condition. Store in dry place, off ground, and keep dry at all times.

PART 2 – PRODUCTS

2.1 COMBUSTION MANAGEMENT SYSTEM

A. The combustion management system shall consist of the following major components:

1. Power-Flame package fuel burners
2. Burner Management System

B. The entire combustion management system shall be complete, coordinated system which shall be designed and supplied by one company. The manufacturer shall be responsible for providing a factory trained engineer for supervision and start-up of the total system. The system shall be as supplied by Bradley-Sciocchetti, Inc. Substitutions only as they conform to the requirements listed under Section 1 "Qualifications".

C. All instrumentation and equipment shall be provided by a single experienced manufacturer. The system shall be installed in strict accordance with the manufacturer's recommendations and under the direct supervision of the control manufacturer's supervision. The system supplier will, as a major part of his business, manufacturer such systems. Further, he shall have a fully staffed factory trained service organization. This service shall be available on a 24-hour emergency basis. It shall also be capable of providing a service contract for facility if so desired by the client after installation of the equipment.

This service shall be fully authorized by the factory as such for all service of this equipment in the tri-state area and shall be further complimented by the central service and engineering department at the factory level.

D. All drawings, submittals and instructions shall be supplied or presented as a complete system. They shall be completely coordinated interphase with all major components and assemblies that make up the system.

2.2 FUEL BURNING EQUIPMENT:

Furnish Two (2) Power-Flame package burner as furnished by BSI, complete with all necessary auxiliaries to fire the existing boiler.

A. Furnish and install Power Flame FD Package Burner Model CR5-G-30 for firing gas. Burner shall be capable of firing at a minimum of:

Gas: 8299 MBH when supplied with a minimum gas pressure of 14.0" and a maximum of 280.0" W.C.

B. The burner shall be of the design which produces flame retention with rapid intimate mixing of fuel and combustion air. The burner shall be capable of being adjusted to optimum efficiency with a trace to a No. 1 smoke on the ringleman chart.

C. The combustion control system shall be low-high-off. The fan inlet damper shall be modulated to provide proper combustion fuel/air ratio at each firing rate. All required air for combustion shall be provided through the burner by an integral motor driven fan which discharges into the burner blast assembly. High turbulence flow is controlled by means of and adjustable fan diffuser system. Fan shall operate at 3450 RPM.

D. Gas train shall conform to UL, IRI, CSD-1 requirements.

E. The Model "C" burner shall incorporate the principle of multiple orifice ventured operation for gas. The total package shall utilize the forced draft, flame retention principle of operation. The burner shall be capable of operating under positive or negative furnace pressure. Gas control valve shall be supplied mounted and field mounted gas train shall be provided.

F. Each burner shall be of welded steel construction. The combustion head shall incorporate a multi blade, stainless steel, flame retention diffuser. The gas firing head shall be of the multiport type and constructed such as to place annular gas distribution opening between two parallel air flow streams to achieve maximum fuel/air mixing. Burners with cast alloy blower housings will not be accepted.

G. The design shall also include a primary air/gas mix chamber constructed such that a mixture of primary air and gas will be introduced into the combustion area, upstream of the secondary combustion air and ignition introduction zone.

H. The forced draft blower wheel shall be of the forward curved centrifugal design and shall be directly driven by a 7.5 HP 3450 RPM 240 volt, 60 Hertz 3 phase motor. A dual blade damper assembly located on the inlet side of the blower wheel shall meter the combustion air flow. Design shall permit the disconnecting and locking of either damper if firing rates are near minimum burner input ratings.

I. The burner ignition system which will light the main flame by spark ignition. The gas pilot system components shall include spark ignited pilot assembly, 6,000 volt ignition transformer, pilot solenoid valve, pilot gas pressure regulator and manual gas shutoff cock. The flame proving system shall incorporate an Ultra-Violet flame detector which will monitor both the pilot and main flames. The pilot assembly shall fit within the confines of the blast tube - avoiding special burner front plate pilot cut

J. Pilot shall be set to accept natural gas.

K. Acceptable Burner Manufacturer include:

1. Power Flame

2. Other manufacturer's burners must comply with specifying engineer's requirements, including:

   a. Full intent of these specifications, and provide complete submittal including literature, wiring diagrams, fuel piping diagrams, and a list of similar installations.

b. Submittal to be presented to specifying engineer at least ten working days for approval before bid opening. Substitutions are not permitted after contract is awarded.

c. Burners must be tested and approved for installation with specified boiler, by the boiler manufacturer.

2.3 LOW NOX:

A. The burner(s) shall be forced draft type for firing gas. Each system shall be capable of being field retrofitted to Low NOx operation without modification to, or replacement of any major component assemblies initially supplied. Future retrofit hardware shall be limited to a factory supplied Low NOx kit. The completed retrofit shall be in accordance with the UL listed Low NOx system normally supplied by the burner manufacturer for new applications.

B. Internal recirculation and staged air burners, where portions of the main flame are combusted within the burner head, behind a cone or diffuser assembly shall not be acceptable due to the potential for burner head failure caused by the resultant thermal stress of the referenced components.

2.4 BURNER MANAGEMENT SYSTEM:

A. Shall be housed in a burner mounted console type panel. Control circuit shall be separately fused and shall be 115V, 1 phase switching or fusing in grounded neutral leg will not be permitted. All control wiring shall terminate at terminal blocks. Wire to be approved, color coded. All flush mounted items shall be identified with plates.

1. Console shall incorporate a hinged and fully removable front access door and shall be complete with top operating station section. This top section shall house all operating switches flush mounted. It shall also be hinged. The above design shall allow full access to all panel mounted components for service and maintenance. Console which does not have this feature will not be acceptable.

2. The following equipment shall be factory pre-mounted, wired and tested in control console:

a. U.V. Flame Safeguard and Programmer – Fireye YB110 with ED-510 Display

b. Proven low fire start

c. Main Fuses

d. Control Circuit Stepdown Transformer

e. Control Circuit on/off station with nameplate

f. Cleveland Air Safety Switch

g. Motor starters for burner motor

h. Burner manufacturer shall supply wiring diagrams

2.5 GASTRAIN:

The gas train shall consist of the following major components and conform to UL, IRI, CSD-1 requirements:

A. Pilot pressure regulator

B. Main gas cock

C. Test gas cock

D. Pilot safety shut-off valve

E. Main gas motorized shut-off valve

F. Aux. motorized gas shut-off valve

G. Normally Open Vent Valve

H. Maxitrol 210 E High Pressure Gas Regulator

2.6 CENTRAL CONTROL CONSOLE:

A. Design shall be such that all indicating devices and manually operated switches are flush mounted on a front panel. All operating controls shall be installed on a subpanel within the enclosure behind gasketed-hinged access doors.

B. All flush mounted items in front panel shall be identified with engraved plastic label plates.

C. Wire shall be UL listed, color coded, and run plastic ducts to numbered terminal block. Control circuits shall be separately fused with cartridge type fuses, properly rated, and shall be 120 volts, 1 phase. Power and control leads shall terminate at terminal blocks so that no field wiring in control compartment is necessary except from terminal blocks to external equipment. All electrical equipment installed and wired in control console shall be electrically tested, simulating complete operational sequence. Console manufacturer shall submit for approval dimensional drawings of control console and comprehensive wiring diagrams showing internal panel wiring and all field wiring from terminal blocks to external equipment, prepare specifically for this job. Typical or standard drawings will not be acceptable.

2.7 BURNER MOUNTING PLATE:

Furnish and install ½" steel mounting plate to mount new Power Flame burner to existing boiler. Burner mounting plate shall be drilled, cut and tapped with necessary openings, as required, to maintain a gas tight fit between new burner and existing boiler. Burner head shall be protected with high temperature castable refractory and insulation as required to provide proper heat protection. Refractory and insulation materials shall be rated at 2800 deg. F. Mounting and bracing of burner shall be in accordance to manufacturer's recommendation.

PART 3 – EXECUTION

3.1 START-UP AND SUPERVISION:

A. The combustion management system as here-in-before described shall be supplied and installed under the continuous supervision of a qualified specialist regularly employed in this capacity by the system manufacturer factory representative. The contractor shall allow in his bid not less than two (2) days per boiler service time for inspection during construction, start-up time and testing by the manufacturer's service engineer. Due to safety of operation only the local factory authorized burner manufacturer shall start up the fuel burner.

B. In addition, the factory representative shall furnish 24 hour/7 day a week service line for warranty service during the warranty period. The Telecommunications Monitor shall direct the 1st dial location to the Service Department Dispatcher line.

3.2 MECHANICAL WORK:

Any mechanical or piping work required to accomplish installation or retrofit of field devices shall be provided by this contractor at no cost to the school district. All work shall be accomplished in accordance with local codes and requirements and executed by individuals certified to perform the work.

3.3 POWER WIRING:

All power wiring required to complete the installation and provide for a fully operational system shall be provided by this contractor at no cost to the school district. All work shall be accomplished in accordance with local codes and requirements and executed by individuals certified to perform the work.

END OF SECTION 23 0400

SECTION 23 0450

REFRIGERATION EQUIPMENT – 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 23 0200 for HVAC General Provisions

C. Refer to Section 23 0210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes labor, material, equipment and supervision to for the following:

1. Condensing Unit (10 to 20 Tons)
2. Ductless Split System Cooling Unit

B. Provide complete refrigeration system including chillers, cooling towers, underground pre-insulated pre-fabricated piping, aboveground piping and all required accessories.

1.3 REFERENCE STANDARDS

A. Refer to Section 23 0200 for a general description of requirements applying to this section.

B. Comply with applicable provisions of:

1. International Mechanical Code
2. ASME Codes for Pressure Vessels
3. A.R.I. Capacity Ratings
4. NFPA Pamphlets
5. ASHRAE Standard 15
6. ASHRAE Standard 90.1, Section 6, Table 6.8.1A thru J, minimum equipment efficiency.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 0210 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.

C. Verification of Fluid Cooler Performance:

1. Manufacturer shall have a thermal performance testing program for water cooling towers certified by the Cooling Technology Institute (CTI) in accordance with CTI Specification Standard STD-201. Manufacturer's performance guarantees or performance bonds shall also be accepted.
2. Unit Sound Performance ratings shall tested and certified according to CTI ATC-128 standard. Sound ratings shall not exceed specified ratings.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 23 0200.

B. Submit the following:

1. Shop drawings and product data for all equipment in this section.

2. 1/4" = 1'-0" scale layout of all equipment in Mechanical Room.

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 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, 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. Manufacturer shall guarantee all refrigeration equipment including parts and labor, for five (5) years from start-up.

PART 2 – PRODUCTS

2.1 CONDENSING UNIT (10-20 Tons)

A. General:

1. Furnish air-cooled condensing unit in accordance with the performance schedule shown on the plans.

2. Install them as shown on the plans in accordance with:

- The manufacturer's recommendations and

- All applicable national and local codes.

3. UL (CSA) approved.

4. Completely assembled for one-piece shipping and rigging.

5. Leak, pressure and functionally tested at the factory to assure a trouble-free start-up after installation.

6. In current production with published literature available to check performance, limitations, specifications, power requirements, dimensions, operation and appearance.

B. Unit Enclosure:

1. A steel angle frame to provide the rigid support required for shipping, rigging and years of dependable operation.

2. Exterior panels of 18-gauge galvanized sheet steel which have been bonderized and finished with baked enamel to provide a long-lasting quality appearance.

3. Removable panels to provide easy access to all internal components for maintenance, service and adjustment.

C. Each compressor shall be mounted on spring isolators and shall be enclosed in a separate compartment to minimize the transmission of sound and vibration.

D. Condenser Coils:

1. Shall be draw-thru, with manufacturer's standard wire guards.
2. Shall be constructed of copper tubes arranged in staggered rows and mechanically expanded into aluminum fins, and
3. Shall have a separate circuit which will provide at least 19 degrees F of liquid sub-cooling at design conditions.

E. Condenser Fan Motors:

1. Shall be directly connected to the condenser fans,
2. Shall have permanently lubricated ball bearings, and
3. Shall have inherent overload protection.
4. Motors shall be of the permanent split-capacitor type.
5. Condenser fans shall be arranged for vertical discharge of the condenser air, with manufacturer's standard wire guards.

F. The wiring for each unit shall include:

1. A crankcase heater (one per compressor).
2. A 24-volt temperature control circuit.
3. High and low pressure circuits.
4. Condenser fan motor controls to assure stable operation of ambient temperatures down to 0 degrees F.
5. Condenser fan and compressor contactors factory wired to pressure lugs or terminal block for power wiring.
6. Factory mounted and wired fused disconnect switch.

G. The refrigerant piping for each system shall include:

1. A strainer-drier,
2. A moisture indicating sight glass, and
3. Service access valves.

The strainer-drier and sight glass may be shipped separately for field installation.

H. Manufacturers: York, Carrier, Trane, Lennox, 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 DUCTLESS SPLIT SYSTEM COOLING UNIT

A. The system shall consist of a compact wall-mounted packaged evaporator section and matching outdoor air-cooled condensing unit. The units shall be listed by and bear the ETL label. All wiring should be in accordance with the National Electrical Code (N.E.C.). The units shall be rated in accordance with ARI Standard 240 and bear the ARI label. A full charge of refrigerant for 100 feet of

refrigerant tubing shall be provided in the condensing unit. A dry nitrogen holding charge shall be provided in the evaporator. System SEER shall meet or exceed 1992 Federal Standards.

B. The indoor unit shall be factory assembled and wired. The casing shall have a white finish. The evaporator fan shall be an assembly with line flow fans direct driven by a single motor. The fan shall be statically and dynamically balanced and run on permanently lubricated bearings. An adjustable guide vane shall be provided with the ability to change the air flow from horizontal to vertical. A motorized air sweep flow louver shall provide an automatic change in air flow by directing the air from side to side for uniform air distribution. Return air shall be filtered by means of an easily removable washable filter. The evaporator coil shall be nonferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. The unit electrical power shall be 115 volts, 1 phase, 60 hertz.

C. The control system shall consist of two (2) microprocessors interconnected by a single non-polar two-wire cable as supplied. Wiring shall run from indoor unit to controller direct. When running longer lengths or more than one set of remote controller wires together, a double insulated, two-wire cable equivalent to that provided; e.g., Belden 9407 cable, is mandatory or use shielded two-wire cable. One microprocessor shall be factory wired and located within the indoor unit. It shall have the capability of sensing return air temperature and indoor coil temperature; receive and process commands from the remote controller; provide emergency operation; and control the outdoor unit. The microprocessor within the wall-mounted remote controller shall provide automatic cooling; display setpoint and room temperature; a 24-hour on/off timer so that automatic operation can be set on the timer at one hour intervals from one to twenty-four hours; have self-diagnostic function display; check mode for memory of most recent problem; control system shall control continued operation of the air sweep louvers; and provide on/off and system/mode function switching. Normal operation of the remote controller provides individual system control in which one remote controller and the indoor unit shall be 12 volts, D.C. The control voltage between the indoor unit and the outdoor unit shall be 12 volts D.C. Both 12 VDC shall be generated from the indoor unit microprocessor board. The system shall be capable of automatic restart when power is restored after power interruption. System shall include twenty function self-diagnostics including total hours of compressor run time.

D. The outdoor unit shall be completely factory assembled, piped and wired. The casing shall be fabricated of galvanized steel, bonderized and finished with baked enamel. The unit shall be furnished with one (1) direct drive, propeller type fan arranged for horizontal discharge. The motors shall have inherent protection, be of the permanently lubricated type and resiliently mounted for quiet operation. The fans shall be provided with a raised guard to prevent contact with moving parts. The compressor shall be of the high-performance rotary type with crankcase heater, accumulator and internal thermal overloads. The compressor shall be mounted so as to avoid the transmission of vibration. The refrigeration system shall be equipped with high pressure switch and have the capability to operate with a maximum height difference of 130 feet and overall refrigerant tubing length of 130 feet between indoor and outdoor sections without the need for line size changes, traps or additional oil. Refrigerant flow from the condenser shall be controlled by means of a capillary tube. The condenser coil shall be of non-ferrous construction with smooth plate fins bonded to copper tubing. The coil shall be protected with smooth plate fins bonded to copper tubing. The coil shall be protected with an integral metal guard. The unit shall be controlled by the microprocessor located in the indoor matching unit. A built-in, low-ambient controller will allow cooling to 0 deg. F outdoor temperature. The unit electrical power shall be 208 volts, 1 phase, 60 hertz.

E. Accessories: A SPST relay with coil voltage to match the operating signal of the DDC System and a "PAC-715AD" cable from Mitsubishi.

F. Manufacturers: Airdale, Carrier, EMI, LG HVAC, Daikin McQuay, Mitsubishi Electric, Panasonic, Sanyo A.C. Products, Samsung.

PART 3 – EXECUTION

3.1 REFRIGERATION EQUIPMENT

A. All equipment to be installed in accordance with manufacturer's recommendations.

3.2 AIR-COOLED CHILLER

A. Install in accordance with manufacturer's recommendations. Unit shall be properly supported and vibration isolated.

B. Provide pipe insulation and jacketing over freeze protection electric heaters on all exterior water piping. Coordinate with the work of Division 26.

3.3 PROCESS COOLING UNITS / DUCTLESS SPLIT SYSTEMS

A. Install packaged and split system units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory mounted.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements. Do not proceed with equipment start-up until wiring installation is acceptable.

3.5 FIELD QUALITY CONTROL

A. Start-up all units in accordance with manufacturer's start-up instructions. Replace damaged or malfunctioning controls and equipment.

END OF SECTION 23 0450

SECTION 23 0451

VARIABLE REFRIGERANT FLOW SPLIT SYSTEM HEAT RECOVERY WITH SIMULTANEOUS HEATING AND COOLING

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 23 0200 for HVAC General Provisions

C. Refer to Section 23 0210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes labor, material, equipment and supervision for the following:

1. Single or Multiple Outdoor Condensing Units
2. Multiple Indoor Ceiling Cassette Cooling Units.
3. MCU refrigerant control unit(s) for simultaneous distribution of liquid and hot gas refrigerant to fan coil units for simultaneous heating and cooling operation.

B. Provide complete refrigeration system including condensing units, cooling units, aboveground refrigerant piping, and all required controls and accessories for a complete and operable system.

C. The variable capacity, air conditioning system shall be a split system consisting of ductless evaporators exclusively matched to the outdoor condensing unit.

1.3 REFERENCE STANDARDS

A. Refer to Section 23 0200 for a general description of requirements applying to this section.

B. Comply with applicable provisions of:

1. International Mechanical Code
2. ASME Codes for Pressure Vessels
3. A.R.I. Capacity Ratings
4. NFPA Pamphlets
5. ASHRAE Standard 15
6. ASHRAE Standard 90.1, Section 6, Table 6.8.1A thru J, minimum equipment efficiency.
7. ISO 9001 and 14001.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 0210 for a general description of requirements applying to this Section.

B. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

C. All wiring shall be in accordance with the National Electric Code (NEC).

D. The system shall be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

E. The outdoor unit shall be factory charged for a length of 25 feet of refrigerant with R410A refrigerant.

F. A dry air holding charge shall be provided in the evaporator(s).

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 23 0200.

B. Submit the following:

1. Shop drawings and product data for all equipment in this section.

2. ¼ " = 1'-0" scale layout of all outdoor equipment adjacent to the building.

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 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, 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. Manufacturer shall warrant all refrigeration equipment including parts and labor, for one (1) year from start-up.

2. Compressors shall be warranted for parts only for an additional four (4) years.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The system performance shall be in accordance with ARI 210/240 test conditions as shown in the performance table below. System refrigerant piping shall be sized and installed per the manufacturer's piping diagrams and piping procedures.

B. The cooling performance is based on 80°F DB / 67°F WB for the indoor unit and 95°F DB /75°F WB for the outdoor unit and 25 feet of piping.

C. The operating range in cooling will be 23°F DB ~ 115°F DB.

D. Provide all equipment, materials, programming and technical support as required to interface with the DDC System as defined in Section 230900.

2.2 INDOOR UNIT

A. General: The indoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Both liquid and suction lines shall be individually insulated between the outdoor and indoor units. The unit shall have a self diagnostic function, 3-minute time delay mechanism, and have a factory pre-charge of R410A adequate for 25 feet of total length.

B. Unit Cabinet Ceiling Recessed Type:

1. The indoor unit shall have a finished cabinet for exposed ductless applications.

2. The drain and refrigerant piping shall be concealed above the finished ceiling for flexible installation from the right side.
3. The cabinet shall be supplied with suspension bracket for securely mounting the cabinet to threaded rod.
4. The cabinet includes a receiver to accept signals from a wired remote controller.
5. The indoor unit shall include a stub duct connection for air distribution to an adjoining zone as shown on the drawings.
6. The indoor unit shall include a factory mounted and wired high lift condensate drain pump capable of 29” lift. The condensate pan shall be internally trapped.

C. Unit Cabinet Ceiling Concealed Ducted Type:

1. The indoor unit shall have a galvanized steel, insulated cabinet for ceiling concealed ducted supply and return air applications. The unit shall contain factory fabricated filter housing suitable for a 1” or 2’ MERV 6 replaceable filter element, complete with side access and coverplate with full gasket.
2. The drain and refrigerant piping shall be concealed above the finished ceiling for flexible installation from the right side.
3. The cabinet shall be supplied with suspension bracket for securely mounting the cabinet to threaded rod.
4. The cabinet includes a receiver to accept signals from a wired remote controller.
5. The indoor unit shall include a high lift condensate drain pump accessory, where applicable, capable of 29” lift. The condensate pump shall be internally trapped.

D. Fan:

1. The evaporator fan shall be an assembly with of a direct-driven single motor.
2. The fan shall be statically and dynamically balanced and operate on a motor with permanent lubricated bearings.
3. The indoor fan shall offer a choice of three speeds, High, Medium, and Low.
4. The supply air shall be distributed to the space through a 4-way blow wide blade grille.
5. The return air shall be returned to the unit through an integral center return air grille.

E. Filter:

1. The return air filter shall be integral to the unit and shall be replaceable or washable, based on unit configuration and manufacturers standard.

F. Coil:

1. The evaporator coil shall be a nonferrous, aluminum fin on copper tube heat exchanger.
2. All tube joints shall be brazed with silver alloy.
3. All coils shall be factory pressure tested.
4. A condensate pan shall be provided under the coil with a drain connection.
5. The evaporator coil shall be controlled by a factory mounted electronic thermal expansion valve.

G. Control:

1. The indoor fan coil unit shall have a wired remote controller capable to operate the system.
2. The wired remote controller shall control: on/off operation, operation mode, fan speed, temperature set point and filter alarm.
3. The wired remote control shall perform fault diagnostic functions which may be system related, indoor unit or outdoor unit related depending on the fault code. Temperature range on the remote control shall be 64°F to 90°F in cooling mode and 50°F to 86°F in heating mode.
4. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote control.
5. The system shall have automatic restart capability after a power failure has occurred.
6. Multiple indoor fan coil units located in the same room shall be controlled in a master/slave configuration with a single wired remote controller connected to the master indoor unit and interconnecting wiring between the master and slave units.
7. The indoor fan coil unit shall include a field installed relay module for interface to the BAS system.
8. Each system shall be networked to a centralized controller with data management service device to provide local schedule and set point control, error history management, and web server browsing from static IP address.

H. Sound:

1. Indoor unit sound levels shall not exceed: 41 dBA

I. MCU Refrigerant Distribution Control Module:

1. The MCU unit shall include refrigerant liquid, suction and hot gas connections to the outdoor unit. All three refrigerant lines shall be insulated from the MCU to the outdoor unit.
2. The MCU unit shall include refrigerant liquid and vapor connections to the indoor units.
3. The MCU unit shall include a 208/230-1-60 power supply connection.
4. The MCU shall include a condensate drain connection.
5. The MCU shall include a control communications connection for network to the indoor fan coil units and outdoor air-cooled condensing unit(s).
6. The MCU shall include heating and cooling solenoid valves for automatic distribution of liquid refrigerant or hot gas for simultaneous heating and cooling fan coil operation.

2.3 OUTDOOR UNIT

A. General: The outdoor unit(s) shall be specifically matched to the corresponding indoor unit size(s). The outdoor unit(s) shall be complete factory assembled and pre-wired with all necessary electronic and refrigerant controls.

B. Unit Cabinet: The cabinet shall be ivory with a finished powder coated baked enamel paint.

C. Fan

1. The fan shall be a direct drive, propeller type fan.

2. The motor shall be BLDC type with permanently lubricated type bearings and inherent overload protection.
3. The fan shall be capable of high static operation up to 0.31" WC for ducted applications.
4. A fan guard is provided on the outdoor unit to prevent contact with fan operation.
5. Airflow shall be vertical discharge.

D. Coil: The outdoor coil shall be nonferrous construction with corrugated fin tube.

E. Compressors:

1. The outdoor unit shall have a minimum two compressors. One compressor shall be a Copeland digital scroll compressor with 10% to 100% capacity modulation and one compressor shall be a Copeland fixed scroll compressor. Outdoor unit shall be capable of capacity modulation down to 10% of full load capacity.
2. The outdoor unit shall have an accumulator.
3. The compressor shall have an internal thermal overload.
4. The outdoor unit shall operate with a maximum vertical height difference of 164 feet and overall maximum piping length of 3280 feet and maximum 721 feet (equivalent length) from outdoor unit to furthest indoor unit.

F. Electrical:

1. The outdoor shall be controlled by a microprocessor located in the outdoor unit and via signals from the indoor units.

G. Sound: Outdoor unit sound levels shall not exceed: 64 dBA

2.4 DESIGN MAKE: Samsung

2.5. MANUFACTURERS: Daikin, Samsung, Mitsubishi (Citi-Multi), LG HVAC, Panasonic.

A. 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 REFRIGERATION EQUIPMENT

A. All equipment shall be installed in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

A. The system shall be installed under the supervision of a certified manufacturer's representative.

B. Start up all units in accordance with manufacturer's start-up instructions. Replace damaged or malfunctioning controls and equipment.

C. Start up service and first year preventative/emergency service shall be provided by the manufacturer's authorized representative.

D. Customer operator training shall be provided by the manufacturer's authorized representative.

END OF SECTION 23 0451

SECTION 23 0500

PIPING SYSTEMS & 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 23 0200 for HVAC General Provisions

C. Refer to Section 23 0210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes the following equipment:

1. Relief Valve (Water Systems)
2. Balancing Valves

1.3 REFERENCE STANDARDS

A. Refer to Section 23 0200 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 0210 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 23 0200.

B. Submit the following:

1. Shop Drawings
2. Manufacturers Product Data
3. Test Reports on Piping System Tests

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 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, 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.

PART 2 – PRODUCTS

2.1 RELIEF VALVE (WATER SYSTEMS)

A. Each water circulating system of the closed type shall be provided with a pressure relief valve selected to suit the system heat generation capacity and set at 75 psig.

B. This discharge from the relief valves shall be piped to a drain.

C. Relief valves shall be manufactured by McDonnell and Miller, Bell and Gossett, A.W. Cash Company.

2.2 BALANCING VALVES

A. Balancing valves shall be installed where indicated.

B. Provide, as shown on the plans, balancing valves with provision for connecting a portable differential (Ft. of Head) pressure meter. Each meter connection shall have pressure/temperature readout ports.

C. The balancing valves shall be either a bronze body/brass ball valve, or a Y-pattern globe valve style design and all metal parts of non-ferrous, pressure die-cast, nonporous Ametal copper alloy. Each valve can be installed in any direction without affecting flow measurement and shall provide four (4) functions:

1. Precise flow measurement
2. Precision flow balancing
3. Positive shut-off with no drop seat and teflon disc
4. Drain port suitable for hose bib fitting.

D. The valves shall have four (4) 360 deg. adjustment turns of handwheel for maximum setting with hidden memory feature to program the valve with precision tamperproof balancing setting.

E. Design Pressure/Temperature:

1/2" - 3" NPT connections 300 psig at 250 deg. F.

1/2" and 3/4" sweat connections 200 psig at 250 deg. F.

2” – 4” flanged or grooved connections 250 psig at 250 deg. F

4" flanged connections 175 psig at 250 deg. F.

F. Flow sensor: For installation in piping 5” and larger, a precision wafer type orifice insert installed between standard 125 psi at 250 deg. F ANSI flanges to monitor system flow; cast iron body with integral brass EPT check valves to accommodate a differential pressure meter; furnish with calibrated nameplate with flow range through a range of differential head pressures; provide globe valve at each sensor to adjust flow to design conditions.

G. Manufacturers: Tour & Andersson, Armstrong, Bell & Gossett, Nexus Valve, Taco, Victaulic, Wheatley.

PART 3 – EXECUTION

3.1 BYPASSES

A. Three-valve bypasses shall be provided in piping at main system control valves, at control valves for heat exchangers, domestic hot water generators, central station air handling units, and where indicated on drawings.

B. The bypasses shall consist of two gate valves and one globe or angle valve. The bypass pipe size shall be at least equal to the control valve size.

3.2 PIPING SYSTEM DRAINS

A. All piping shall be graded or pitched toward drain locations which shall be provided with gate valve unless otherwise indicated on drawings or specified. Individual risers may be drained through removable plugs or caps.

B. Drain valves shall be provided at all major components in systems including boilers, pumps, heat exchangers, cooling towers, and similar equipment.

3.3 ECCENTRIC PIPE FITTINGS

A. Eccentric pipe fittings shall be furnished and installed in all piping and circulated water piping where a change in pipe size occurs in a horizontal run. In water systems the top of the adjacent pipe sections shall be maintained level.

3.4 CHEMICAL CLEANING

A. New boilers shall be boiled out with an alkaline type boiling out compound to remove grease, oil, mil scale and other foreign matter. The compound should be used at the rate of 1-1/2 pounds per 20 boiler horsepower. After the boiling out period, the boiler shall be completely drained, flushed and refilled with fresh water.

B. Closed re-circulating systems shall be filled and sufficient detergent and dispersant added to remove all dirt, oil and grease. System shall be circulated for at least 48 hours after which a drain valve at the lowest point shall be opened and allowed to bleed while the system continues to circulate. The automatic make-up valve shall be checked to be sure it is operating. Bleeding shall continue until water runs clear and all detergent is removed. A sample of water shall be tested and if pH exceeds 8.0, draining should be resumed.

C. Drain all detergent solution from system piping and equipment to nearest floor drain or indirect waste point connected to the building's sanitary system.

END OF SECTION 23 01500

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 23 0200 for HVAC General Provisions

C. Refer to Section 23 0210 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. Ductwork - Single Wall, Spiral Round
3. Flexible Air Duct
4. Flexible Connections
5. Dampers
6. Air Diffusers, Registers and Grilles

1.3 REFERENCE STANDARDS

A. Refer to Section 23 0200 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 23 0210 for a general description of requirements applying to this Section.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 23 0200.

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 ¼".

   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 2" W.G. Ductwork systems shall be sealed to SMACNA "Seal Class "A" Standards. Alternatively, "Ductmate" System 45 can be used in accordance with manufacturer's specifications. Drive slip joints are not permitted.

   Exception: For ductwork <u>smaller</u> 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 2" W.G. or less, positive or negative pressure shall be per SMACNA Table 1-7. Longitudinal seams shall be Pittsburgh Lock Type L-l 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. 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.

2.2 DUCTWORK (SINGLE WALL, SPIRAL ROUND)

A. Design Pressure: 2”

B. Leakage: All ductwork shall meet SMACNA Class "A" leak standards.

C. Fabrication:

1. Gauges, reinforcing angles, seams, joints, fabrication methods, installation methods and practices, duct reinforcement, fabricated dampers and devices installed in duct system, fittings, etc., shall conform to the latest editions of SMACNA standards for construction in accordance with requirements indicated in these specifications.
2. Minimum metal gauges shall be 26 gauge (.019). Follow SMACNA Table 3-2A for Positive pressure and Table 3-2B for Negative pressure.

D. Joints:

1. Duct up to 36" diameter - Male/Female beaded slip joint similar to SMACNA Figure 3-2, joint RT-1 or RT-5, as long as it meets the criteria for the system design pressure. Fittings shall be undersized to fit into spiral duct. All joints shall be secured with a minimum of 4 screws on each duct section (equally spaced). Seal joint with an approved sealant compound, continuously applied prior to assembly of joint and after fastening, making certain that the majority of the sealant resides on the interior of the joint.
2. Duct 37" - 60" diameter: Companion angle Vanstone with full face gaskets having bolt holes punched through prior to insertion of bolts. Gasketing shall be 1/8" thick. Joint is per SMACNA Figure 3-2, joint RT -2 and RT -2A.
3. For all dust collection and particulate carrying duct, SMACNA Figure 3-2, joint RT -3 up to 16" diameter and RT -2 or RT -2A are the only acceptable joints. RT -3 joints do not require any additional sealant as long as the band has gasketing installed by manufacturer. Joints RT -2 and RT -2A require full face gaskets having bolt holes punched through prior to insertion of bolts. Gasketing shall be 1/8" thick. There shall be no fasteners penetrating the duct for collection systems.
4. In lieu of beaded slip connections or Vanstone angle ring connections (the above-mentioned joints), there are proprietary connections that may be used, as long as they meet the pressure criteria set forth in this specification.

2.3 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.

2.4 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. Dampers shall be Ruskin Model MD35.

D. Approved Manufacturers: Ruskin, Arrow, Nailor-Hart, Pottorff, Lloyd Industries, Inc., Cesco Products, Louvers & Dampers, United Enertech.

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.

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.

J. 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.

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 ductwork shall be pressure leak tested:
   1. Supply ductwork
   2. Return ductwork
   3. Exhaust ductwork
   4. Outside air intake ductwork

B. All tests shall be conducted in accordance with AABC National Standards.

C. Ducts to be tested at 100% maximum of static pressure before any duct is insulated externally and concealed in accordance with SMACNA Standards.

D. Calculate the allowable leakage using leakage factor of 5% of Design Air Flow.

E. Select a limited section of duct for which the estimated leakage will not exceed capacity of the test apparatus.

F. Connect the blower and flow meter to the duct section and provide temporary seals at all openings of the ductwork.

G. Start the blower motor with the inlet damper closed. Increase pressure until the required level is reached.

H. 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.

I. 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.

J. Complete test reports and obtain Owner's witness signature.

K. Remove all temporary blanks and seals.

L. 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 ide ntification 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, 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.

END OF SECTION 23 0600

SECTION 23 0730

TERMINAL HEATING AND COOLING 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 23 0200 for HVAC General Provisions

C. Refer to Section 23 0210 for HVAC Basic Materials & Methods.

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. Unit Ventilators (Heating & Cooling)
2. Evaporator Coils

1.3 REFERENCE STANDARDS

A. Refer to Section 23 0200 for a general description of requirements applying to this section.

B. Media type air filters shall comply with U.L. Standard 900.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 0210 for a general description of requirements applying to this Section.

1.5 SUBMITTALS

A. Submit shop drawings in accordance with Section 23 0200.

B. Submit shop drawings and descriptive date 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 warranty.

PART 2 – PRODUCTS

2.1 UNIT VENTILATORS

A. Cabinet and Chassis

1. Unit frames shall be of unitized, welded construction, with structural elements aligned in an assembly jig prior to welding, to insure proper dimensions, rigidity, and squareness. Frames assembled with mechanical fasteners shall not be acceptable.
2. Internal sheet metal parts shall be constructed of galvanized steel to inhibit corrosion.
3. Exterior cabinet panels shall be fabricated from furniture grade steel of not less than 16-gauge steel with no sharp edges and no unsightly screw heads and shall receive an electro-statically applied powder paint, and be oven baked with environmentally friendly thermosetting urethane powder finish to provide a high quality appearance. Finish color shall be selected by Architect from manufacturer's standard colors.
4. The interior areas of the unit ventilator shall be insulated for sound attenuation and to provide protection against condensation of moisture on or within the unit. The unit shall be provided with an ultra-quiet sound package consisting of acoustically marched low speed fans to fan housing, sound barrier insulation material (non-fiberglass) adhere to the bottom underside of the unit top panel, sides of the fan section and sound absorbing insulation (non-fiberglass) material applied to the unit front panel.
5. Units shall be constructed so that testing and troubleshooting can be accomplished in the end pockets of operating units, without affecting the normal air flow patterns through the unit.
6. Each unit shall be provided with a non-fused power interrupt switch that disconnects the main power to the unit for servicing or when the unit is to be shut down for an extended period of time. The fan motor and controls shall have the hot line(s) protected by factory installed cartridge type fuse(s).
7. The manufacturer shall have published caraloged sound data available for the engineer's review. Sound data shall have been conducted using a qualified reverberant room per ANSI S1.31 and ANSI S12.32. Sound test data shall be based on standard CFM at standard air (fixed density of air at 70°F) in accordance with ARI procedures based upon ARI 350. The engineer shall have the right to reject equipment not conforming to the specified manufacturer's sound data, as a minimum. Sound levels shall not exceed those shown below:

Octave Band and Center Frequency (Hz)								
UNIT CFM	Speed	2 125	3 250	4 500	5 1000	6 2000	7 4000	8 8000
750	High	57.4	51.8	52.5	52.6	51.2	46.9	35.2
	Med.	50.1	44.9	45.6	44.8	42.8	34.2	19.9
	Low	45.6	40.4	40.8	39.1	35.7	24.4	12.0
1000	High	57.0	52.8	53.9	53.7	51.5	46.8	35.9
	Med.	52.9	48.6	50.2	49.6	46.5	40.1	27.9
	Low	49.4	45.4	47.0	45.5	42.0	33.6	20.7
1250	High	62.4	55.2	55.7	55.3	54.4	49.7	38.5
	Med.	59.3	52.1	52.5	51.7	50.4	44.0	31.8
	Low	55.6	48.6	49.1	47.2	45.6	37.1	24.0
1500	High	63.8	56.6	58.0	58.2	56.4	52.4	41.9
	Med.	58.4	51.3	52.7	52.4	49.5	43.5	30.5
	Low	54.8	47.6	49.4	47.5	44.2	36.2	21.5
Sound Power Levels - dB re 10-12 watt								

- Test data based on valve control unit having 3 rows of coil and no outdoor air. Sound power data may vary based on the type of unit, number of coil rows and other external factors.

B. Floor Units

1. Floor mounted units shall have an integral pipe tunnel for convenient crossover pf piping and a built-in metal wire raceway from right end compartment to left end compartment to contain any line voltage electrical wiring separate from the air stream. Line voltage wiring shall not be touchable in the air stream of the unit during normal maintenance procedures of oiling bearings or motors. Unit shall come standard with a factory installed and wired disconnect switch.

2. Unit top surface shall be supplied with a charcoal bronze textured finish, to resist scuffing, reduce glare and help hide fingerprints. Unit top shall have two access doors, one at each end (for access to motor and bearings for easy servicing). The front and ends shall be available in a selection of architecturally pleasing colors by the manufacturer, for selection by the Architect.

3. Unit discharge grille shall be constructed of continuous rounded edge steel bars to provide 10 degree vertical deflection. A ¼" painted, galvanized mesh screen shall be provided beneath the discharge grille to protect against objects being dropped through the discharge grille.

4. The unit top and grille shall be aof a modular construction so that it is removable for service and maintenance.

5. The unit front surface shall be comprised of three separate removable panels. The controls and piping shall be accessible without removing the entire front panel. Panels shall be secured to the unit with recessed, tamper resistant, Allen head fasteners. Slots for flat head screwdrivers shall not be acceptable as tamper resistant.

6. An extended cabinet depth unit, 21-7/8" deep, shall incorporate a partial adapter back with an open pipe tunnel with the same features of the standard cabinet depth units with the additional capability of bringing in fresh air from 1" to 13" from the floor. The outdoor fresh air enclosure shall be insulated to form a thermal barrier. The vertical and horizontal insulated fresh air enclosure metal extensions shall have a 1" wide compressible gasket to form an airtight seal between the wall and the unit. The top shall be supported with metal braces. The space between the top extension and insulted fresh air enclosure shall arrive from the factory without the requirement to be field modified for the installation of piping or moving of a partition that would require re-sealing. A field removable horizontal support plate between the unit bottom and top shall not be acceptable.

C. Coils

1. Coil assembly shall be of a modular construction so that it is removable from the front of the unit.

2. All coils shall be installed in a draw through position to assure uniform air distribution over the full-face area of the coil, and an even unit discharge temperature.

3. All heating and cooling coils shall be constructed with copper tubes and mechanically bonded aluminum corrugated plate type fins. All coils shall have aluminum individual unshared fin surfaces. An air break shall exist between coils.

4. Water heating and cooling coils shall be furnished with a threaded drain plug at the lowest point and a manual air vent at the high point of the coil. A factory installed low temperature freezestat shall be provided on the leaving edge of the water heating coil in a wave-like configuration to sense multiple locations and shall react to possible freezing conditions. The unit mounted controls shall incorporate this device.

D. Drain Pan

1. All units shall have a drain pan constructed of corrosion resistant, composite material and shall be insulated. A drain outlet shall be provided on both ends of the pan. The drain hand of connection shall be easily field reversed by relocating the cap to the opposite end.

2. The drain pan shall be able to be sloped in either direction for proer condensate removal.
3. Drain shall be provided with a secondary, overflow drain connection on both ends of the pan.

E. Fans and Motor

1. The fan and motor assembly shall be of a low speed design to assure maximum quietness and efficiency.
2. Fans shall be double-inlet, forward-curved, centrifugal type with offset aerodynamic blades. Fans and shaft shall be statically and dynamically balanced as an assembly in the unit before shipment.
3. Fan housing shall be constructed of galvanized steel incorporating logarithmic expansion for quiet operation. Fan and motor assembly shall be of the direct drive type. Belt drive fans shall not be allowed.
4. Motors shall be 155 volt, single phase, 60 Hz, NEMA permanent split capacitor (PSC), plug-in type with auto reset internal thermal overload device designed specifically for unit ventilator operation. Motors shall be located out of the conditioned air stream.
5. All components of the fan/motor assembly shall be removable from the top of floor-mounted units.
6. Units shall have sleeve type motor and fan shaft bearings, and shall not require oiling more than annually. All bearings shall be located out of the airstream. Bearings in the air stream are not acceptable.
7. Motor speed shall be controlled by factory mounted multi-tap transformer for three (3) speeds, HIGH-MEDIUM-LOW-OFF (not accessible from the exterior of the unit). Fan motor and controls shall each have hot leg protected by a factory installed cartridge fuse.

F. Face and Bypass Damper

1. Each unit shall be provided with a factory-installed face and by-pass damper, constructed of aluminum. The long sealing surfaces of the damper shall seal positively against stops fitted with extruded EPDM rubber seals. Face and bypass dampers without sealing edges to prevent air bypass shall not be acceptable. The damper ends shall have blended mohair seals along the ends glued to the damper end for a positive seal. Plastic clip-on brush ends seals shall not be acceptable as an end seal. The unit design shall incorporate the face and bypass damper to prevent coil surface wiping and be before the fan in a draw-thru configuration. The face and by-pass damper shall be arranged to have a dead air space to minimize heat pick-up in the by-pass position.

G. Outdoor and Room Dampers

1. Each unit shall be provided with separate room air and outdoor air dampers.
2. The room air damper shall be two-piece, double-wall construction fabricated from aluminum, and be counterbalanced against backpressure to close by gusts of wind pressue, thereby preventing outdoor air from blowing directly into the room.
3. The outdoor air damper shall be two piece, double wall construction fabricated from galvanized steel, with ½" thick, 1-1/2 lb density glassfiber insulation encapsulated between the welded blade halves for rigidity and to inhibit corrosion. The outdoor air damper shall have additional foam insulation on the exterior surface damper blade and on the ends of the outdoor air chamber. A single blade damper, which can be twisted and will leak air, will not be considered.
4. Dampers shall be fitted with blended mohair seals along all sealing edges. Pressure adhesive sponge neoprene or plastic clip-on brush type sealers for damper seals are not acceptable. Rubber type gasket using pressure adhesive for fastening to metal and exposed to the outside air is not acceptable.

5. Dampers shall use the turned-metal principle on long closing ends with no metal-to-metal contact for proper sealing.
6. The damper shaft shall be mechanically fastened to the blade, and shall operate in bearings made of nylon or other material which does not require lubrication.

H. Filter

1. Each unit ventilator shall be equipped with a one-piece filter located to provide filtration of the return air/outdoor air mixture, in lieu of separate filters for each air stream. The entire filter surface must be useable for filtration of 100% room air or 100% of outdoor air. The filter shall be easily accessible from the front, and removable in one piece without removal of the unit return air damper stop. The unit shall ship with a factory installed 1" think fiberglass, single-use type.
2. Spare filters shall be:
   a. 1" thick fiberglass, single-use type.
   b. 1" thick permanent wire mesh washable
   c. 1" thick permanent metal frames with replaceable media.

I. Control Components

1. The unit ventilator shall come with a factory installed pre-wired control package (called DigitalReady) of Direct Digital Control (DDC) control components which facilitates field hook up of DDC Unit Ventilator Controllers (UVC) by others which are compatible with the factory installed sensors and actuators and capable of providing standard ASHRAE II cycle control sequence. Electrical wiring shall be isolated from the airstream. It shall be the entire responsibility of the Automatic Temperature Control (ATC) supplier to ensure the controls operate correctly and protect the unit. DigitalReady shall consist of the following components which are factory wired and powered:
   a. 75 VA 24-volt NEC Class 2 transformer (50 VA or less is not acceptable) for 24-volt power supply with a complete 24-volt power wiring harness terminating in the left-hand end compartment at three 10-pole Europa type 16 awg terminal blocks rated for 10 amps at 300 volts.
   b. Terminal strips hooked up with the fan motor start/stop relay
   c. A factory installed Low Air Temperature Limit (Freezestat)
   d. Unit mounted 10K NTC (Negative Temperature Coefficent) and 1K PTC (Positive Temperature Coefficient) Discharge Air Temperature Sensors.
   e. Unit mounted 10 K NTC and 1 K PTC Outdoor Air Temperature Sensors
   f. 24 VAC powered wired to the damper actuators
   g. Direct coupled, proportional control 0 to 10 Vdc, or 4 to 20 mA), 35 inch-ounds or torque Outdoor Air/Return Air Damper Actuator that spring-returns the outdoor air damper shut upon a loss of power
   h. Direct coupled proportional control (0 to 10 Vdc, or 4 to 20 mA) Face and Bypass Damper Actuator, non-spring returned
   i. Terminal locations for 24-volt power to one or two End of Cycle valves (by ATC control contractor)
   j. Direct coupled floating point (tri-state) Modulating Valve Actuator, non-spring returned

k. Terminal connectors for interface with a DDC UVC Controller (by ATC control contractor).

J. Control Functions

1. The Unit Ventilator Digital Controller (here after referred to as UVC) shall support ASHRAE Cycle II operation. The control cycle shall be used to maintain the required minimum amount of ventilation whenever possible, which can be increased during normal operation for economizer cooling, but can also be reduced to prevent excessively cold discharge air temperatures.

2. Cool Mode

3. Water Coil Leaving Air Temperature Thermostat (Freezestat)

a. A normally-closed Low Temperature Thermostat (Freezestat) shall be factory provided to detect low leaving air temperature conditions on the unit indoor air hot water coil. This thermostat shall be mounted on the discharge airside of the units hot water coil. The low temperature thermostat cutout shall be 38°F (38°C) +/-2 and the cut-in shall be 45°F (38°C) +/-2. When the low temperature thermostat detects low leaving air temperatures (contact opens) the following shall occur during Face and Bypass Heating operation: when the freezestat cuts-out the OAD shall close immediately, the heating EOC valve shall fully open immediately, any mechanical cooling shall be de-energized immediately. If heating is required, the Face and Bypass damper shall modulate, as needed, otherwise the Face and Bypass damper shall go to 100% bypass, auxiliary heat may be used as needed. When the Freezestat resets or cut-in the UVC shall return to normal operation. If the freezestat trips more than 3 times in one ten day period, the system shall have to be manually rest.

K. Unit Ventilator Options/Accessories

1. Where indicated, the unit ventilator supplier shall provide wall hung enclosure fronts for under sill mounting, flush with the top of the unit ventilator. Each enclosure shall have extruded aluminum inlet grilles/stamped inlet grilles located in the enclosure top, and adjustable dampers below the grille for final airflow adjustment. Enclosure front and bottom panels shall be solid, and finished to match the unit ventilator finish. All sleeves, wall mounting plates, and end caps shall be provided to complete the installation.

L. Basis of Design

1. Dakin

2. Acceptable Alternates

a. With prior approval only. Submit detailed listing of all variations in form, fit, or function, in addition to specified submittal data for approval before bidding. Equipment or manufacturers not listed in this specification shall not be acceptable or approved for installation. Provide required information as specified in Section 01350.

2.2 EVAPORATOR COILS

A. Casing: enclosure shall be 22-gauge steel with baked enamel finish.

B. Coil:

1. Evaporator coils shall be constructed of 3/8" OD copper tubes, mechanically expanded into aluminum fins.

2. Condensate drain pan shall be constructed of galvanized steel.

C. Refrigerant Piping:

1. A factory piped capillary or thermal expansion valve shall control refrigerant flow.

2. Suction and liquid refrigerant connections shall be equipped with brazed copper sweat connections.
3. Coil shall be leak tested, dehydrated and shipped with a refrigerant holding charge.

D. Warranty/Service: Manufacturers shall furnish each unit with the following warranty/service:

One year full parts warranty.

E. Manufacturer: USA Coil & Air Co., Carrier, Trane, York/Johnson Controls.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Install in accordance with manufacturer's recommendations. Unit and all component sections shall be properly supported and vibration isolated.

C. When unit has been used during the construction period, the following shall be done prior to balancing and adjusting of system:

1. Permanent filters shall be washed as required to obtain clean condition and coated with proper adhesive.
2. Throwaway type filters shall be replaced with new. The Mechanical Contractor is responsible to provide and install new throwaway filters upon project's substantial completion. The Mechanical Contractor shall notify Owner's maintenance personnel prior to installation.

3.2 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 operating. 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. Perform field mechanical balancing in accordance with Section 23 0950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.

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 Contractor and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION 23 0730

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 23 0200 for HVAC General Provisions

C. Refer to Section 23 0210 for HVAC Basic Materials & Methods.

D. Refer to Section 23 0450 for Refrigeration Equipment – HVAC.

E. Refer to Section 23 0615 for Airflow Measurement Devices.

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. Packaged Air-to-Air Energy Recovery Heat Pump Unit

1.3 REFERENCE STANDARDS

A. Refer to Section 23 0200 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 23 0210 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 23 0200.

B. Submit shop drawings and descriptive date 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 PACKAGED AIR-TO-AIR ENERGY RECOVERY HEAT PUMP UNIT

A. Furnish and install REZNOR Model ZQYRA hybrid heat pump unit or approved equal. for treatment of ventilation air per plans and specifications.

1. Unit(s) shall be completely factory assembled, tested, internally wired, fully charged with Refrigerant R410A, and shipped in one piece. Unit(s) shall consist of insulated weather-tight casing with field installed outdoor intake hood, field installed exhaust air hood, direct digital compressor, coils, supply fan, exhaust fan, motors and drives, total enthalpy wheel and unit controls.

2. Heat pump systems shall be designed to provide capacity control from 10-100% in both heating and cooling mode. Hot gas bypass or unit staging options shall not be allowed as a means for capacity control. The heat pump shall not require reverse cycle system defrost of any type for outdoor air temperatures above 0°F. Hermetic compressors shall include a scroll design with internal pressure relief and motor temperature winding protection. Units shall be equipped with reversal rotation protection. The system coils shall have an SHR less than 0.75 insuring proper dehumidification of the outdoor air stream. All Coils shall be leak tested and charged at the factory for immediate operation upon installation and check-out of the unit. Refrigeration control shall include thermal expansion valves, external equalizers and distributors, check valves, system reversing valves and all other necessary components to insure proper operation. Refrigeration protection shall include low and high pressure switches, refrigerant circuit frost protection, liquid line filters/dryers and service gage ports. The supply air coil shall have a corrosion proof drain pan with 1/8” slope for proper draining of the condensate. The unit shall allow proper condensate trapping external of the unit. The unit shall have 2” filter racks with MERV 8 filters in each air stream be-fore the wheel and coils. The unit shall have direct access to each filter section for inspection and changing of the filters. The unit control system shall monitor critical heat pump system parameters and shut off the system whenever an alarm occurs: The system shall indicate the following failures: high discharge temperature, excessive compressor current, locked rotor, demand signal loss, discharge thermistor fault, welded contactor, low supply voltage. The refrigerant system shall have an adjustable 5 minute minimum ON and minimum OFF timer circuit protection. The refrigerant circuit shall have an anti-cycle time in addition to the minimum ON/OFF timer that prevents the compressors from cycling on the minimum timer circuit. The unit shall be fully operational from -10°F thru 115°F ambient conditions.

B. Total Energy Enthalpy Wheel

1. The system shall utilize a total enthalpy wheel to capture waste heat energy from the building exhaust air stream for conditioning of the entering outdoor air stream. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt. The wheel shall not allow more than 5% crossover between the supply

and exhaust air stream. The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity. The wheel shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix. The wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory recognized component and shall be mounted in the cassette frame and sup-plied with a service connector or junction box.

C. Fans

1. The unit supply fan shall consist of centrifugal backward curve fan with 96% efficiency electronically commutated motor (ECM). The motor RPM shall be directly set by the package unit control system. The balancing contractor shall have direct access to set the motor RPM through the unit mounted control system display. The unit exhaust fan shall consist of a centrifugal backward curve fan with 96% efficiency electronic control motor. Each supply and exhaust fan shall have a differential pressure switch to indicate fan air flow status to the units control system. When applicable for indoor installation, the unit shall have horizontal discharge connections.

D. Auxiliary Heat

1. The manufacturer shall provide a factory or field installed electric resistance heat for the unit located in the outdoor air stream. Unit shall include field-replaceable heat sections. The electric resistance heater shall have an open element with insulated ceramic bushing, contactors, auto reset high temperature limit switch and other necessary safety devices.

E. Casing

1. Outer casing shall be fabricated from G90 galvanized steel substrate with 60 gloss painted finish coat. Structural members shall be 18 gauge with access doors for the following sections: intake air filters, exhaust air filters, supply and exhaust fans, evaporator and condenser coils, drain pan, compressor, power connections, and unit controls. Roof panels shall be 20 gauge with double-wall 1” insulation liner. The cabinet design shall prevent condensation forming on the outside of the unit casing in operation. Access panel doors shall be fully-gasketed. Access panel door to the supply fan shall be of double-wall construction. Cabinet and mounting base shall be arranged for indoor installation. The unit control panel section shall be laid out to provide separation of high and low voltage components per UL standards. For ease of service, all electrical components shall be clearly identified with 1/2” diameter self-adhesive labels to match the unit specific wiring diagram.

F. Controls

1. The unit shall have a fully integrated control system that directly controls the heat pump, enthalpy wheel and fans to condition the entering air stream. The unit shall have a factory mounted display that indicates all unit status, parameters and alarms. The displays shall allow complete access to unit set points and mode. The control system shall allow normal operations, manual test mode, automatic test mode and alarm mode operation. The air balancing contractor shall have access to the control system to set the unit CFM by adjusting the fan motor RPM. The control system shall allow users to change the discharge air set points, allow unit time scheduling and reviewing of alarm conditions. The operation of the unit shall be based upon co2 sensor with manual hand/off/auto override.

G. Warranty

1. The unit shall carry a five (5) year limited warranty on all parts and components.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

B. Install in accordance with manufacturer's recommendations. Unit and all component sections shall be properly supported and vibration isolated.

C. When unit has been used during the construction period, the following shall be done prior to balancing and adjusting of system:

1. Permanent filters shall be washed as required to obtain clean condition and coated with proper adhesive.

2. Throwaway type filters shall be replaced with new. The Mechanical Contractor is responsible to provide and install new throwaway filters upon project's substantial completion. The Mechanical Contractor shall notify Owner's maintenance personnel prior to installation.

3.2 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 23 0950: 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 23 0900: ATC.

B. 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).

E. 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 23 0200 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 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 manufacturer.

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 and existing pneumatic controls 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, electric actuated devices, new. 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 an extension of the existing Johnson “Metasys” Controls and Trane Niagra head end DDC System of automatic temperature control which shall be as manufactured by Alerton Technologies, Inc., as installed by Advanced Power Control, Inc., 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, Trane controls, and Andover Controls, Inc., as installed by Tri-M Controls, Inc. 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. Make-up Water Monitoring System (Typical for chilled water & hot water heating system):

(Manufacturer's Rep. 888-397-5353)

a. Monitor data as received by flow meter on cold water make-up system. When flow exceeds 10 gal./1 min (adj.), ATC system to close normally open solenoid valve, alarm system (provide call out), shutdown boilers, pumps, chillers, etc., associated with respective system.

b. Flow sensor, consisting of a removable flow sensor mounted in cast bronze housing, available in ½" to 1-1/2" pipe size. Sensor shall be rated for a flow range of 0.5 to 15 feet per second, 220°F max., 400 psig at 100°F max. pressure; Nylon impeller, Pennlon bearing, tungsten carbide shaft, PPS housing and EPDM seals. Manufacturer: Kele Model 250B, Data Industrial Series 250BR.

c. Programmable analog flow transmitter shall be a loop-powered device that converts a flow sensor signal into a linear 4 – 20 mA signal. Electronic signal dampening, computer programmable, compact size in a metal enclosure. Power input, 9-35 VDC/0-1 kHz, 75 ohms at 24 VDC, accuracy of 0.1% of full scale. Manufacturer: Kele Model 310-02, Universal Flow Transmitter Model UFT-1.

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 MOTORIZED, ROTARY ELECTRIC CONTROL VALVES

A. Capacitor type reversible electric motor, gear train, limit switches and terminal block in a die-cast aluminum enclosure, NEMA 4, for outdoor locations.

B. Output shaft shall e nickel plated to prevent corrosion. Actuator shall be suitable for any mounting position, in ambient range from -40 to +150°F.

C. Actuator shall be sized against the operating torque required by the butterfly valve manufacturer.

D. Motor shall be fractional horsepower, permanent split capacitor type designed for 120 VAC, 1 phase supply.

E. Reduction gearing shall be hardened alloy steel, permanently lubricated. Two (2) adjustable CAM actuated end travel limit switches shall be provided to control direction of travel.

F. Actuator shall be provided with handwheel for manual override operation of the valve in the event of malfunction or power failure. Handwheel shall be permanently attached to the actuator.

G. When in manual, the electric drive mechanism shall be locked out for safety.

H. Actuator shall have visual indication of valve position.

I. Valve actuator shall be Raymond Control Systems MAR-100 Series with Dezurik high performance butterfly valve.

2.9 SEQUENCE OF OPERATION

A. Unit Ventilator with Dual Temperature Coils

1. The sequence that follows is typical for all units. Each unit ventilator shall be controlled by an individual DDC controller. Fan speed shall be selected manually at each unit.

   a. Provide a wall mounted space temperature sensor and humidity sensor which shall be wired to the DDC controller.

   b. Provide a 3-way control valve and actuator for each water coil for installation.

   c. Provide actuators for the face & bypass dampers and the outside air/return air dampers.

2. Morning warm-up:

   a. Based on the occupancy schedule in the OWS and prior to the switchover to occupied cycle, the fan shall energize, outside air damper shall remain closed until space temperature is restored to the occupied setpoint for either heating or cooling. When occupied temperature is reached, the outside damper shall open to occupied position. Return air damper shall move in

unison.

3. Occupied Mode:

   a. During the programmed occupied mode, the supply fan shall run continuously with the outside air damper open to its minimum position. On a rise in temperature above the programmed cooling set-point, 75°F (adjustable), the 3-way control valve shall open full to the coil and the space sensor shall modulate the face and bypass dampers to maintain set-point. On a fall in temperature the reverse shall occur.

   b. On a drop in temperature below the programmed heating set-point, 70°F (adjustable), the 3-way control valve shall open full to the coil and the space sensor shall modulate the face and bypass dampers to maintain set-point. On a rise in temperature the reverse shall occur.

4. Unoccupied Mode:

   a. During the programmed un-occupied cooling and heating modes, the fan, coil control valves shall modulate to maintain the un-occupied set-points 85°F cooling/60°F heating (adjustable). The outside air damper shall remain closed, return air damper shall fully open, face & bypass dampers shall be fully open to coil face.

5. Provide a current sensor on one phase of power feeding the supply fan for status indication at the Operator's Terminal.

6. If the discharge temperature fails to rise to a programmed minimum temperature during a call for heating or cooling; a low and high temperature alarms shall be activated at the Operator's Terminal.

7. A low limit control (freeze stat) shall be installed in the unit. When tripped, the freeze stat shall function to de-energize the supply fan, damper actuators, and water control valves. When de-energized, the damper actuator shall spring return the outside air damper closed, open face & bypass dampers to full face; the water coil control valves shall spring return open to each coil. When the freeze-stat trips, an alarm shall be generated at the Operator's Terminal.

8. The following items shall be displayed at the Operator's Terminal:

   a. Space temperature.

   b. Space temperature set-point.

   c. Low Space temperature alarm

   d. High Space temperature alarm.

   e. Discharge temperature.

   f. Global outside air temperature.

   g. Freeze stat status, normal/alarm.

   h. Commanded status of fan, off/on.

   i. Commanded position of control valves, open/closed.

   j. Commanded position of OA damper, open/closed.

B. Split System Unit Control:

1. The following sequence is typical for each of the ductless split system AC-1/ACC-2.

2. System shall be controlled by its factory controls, subject to remote activation through the OWS. Mount and wire the thermostat, which is furnished by the equipment manufacturer, and interlock

the controls from the indoor unit to the outdoor unit. Set to maintain 75 degrees, F. Adjust settings to cycle fan with setpoint.

3. Provide a space mounted temperature sensor for monitoring and alarm generation at the OWS. On a rise in space temperature above the programmed high limit setpoint of 80 degrees F, adjustable, an alarm shall be activated.
4. The following items shall be displayed at the OWS:
   a. Space temperature – use existing space sensors where available.
   b. High limit alarm and setpoint.

C. Energy Recovery Heat Pump

1. The sequence that follows is for units ERU-1, ERU-2. The unit consists of supply fan, exhaust fan, energy recovery module, heat pump coil and condensate, filters, air control dampers and actuators.
   a. The unit is a constant volume system with 100% outside air operation.
   b. The ERV shall be controlled by an individual DDC Controller wired to sensors which shall include, but are not limited to, a discharge air temperature sensor, exhaust air temperature sensor, return air temperature sensor, outside air temperature sensor, heat pump coil discharge air temperature sensor..
2. The BAS Contractor shall provide all required sensing and control devices.
3. The following items shall be provided by the equipment manufacturer:
   a. Motor starters and overload protection.
   b. Defrost controller.
   c. Dampers and damper motors with end switches.
   d. Terminal blocks for all wiring connections between equipment and control devices.
4. The occupied/unoccupied schedule shall correspond to the occupancy schedule for the area of the building served by the unit. Delay unit startup until the zone space temperatures have recovered from their setback or setup temperature setting. During the programmed occupied mode, the supply fan and exhaust fan shall run continuously with the outside air and exhaust air dampers open. Energize heat pump cycle to maintain discharge air temperature.
5. During the programmed un-occupied mode, the fans shall be off and all dampers shall be closed.
6. Interface with a common fire alarm input from the fire alarm system. The fire alarm contact shall be provided at the fire alarm panel by the fire alarm contractor. The status of the alarm contact shall be communicated throughout the BAS. When the fire alarm contact indicates an alarm condition, the BAS shall de-energize the supply fan, exhaust fan, and damper motors. When de-energized, the damper motors shall spring return the outside and exhaust air dampers closed. Provide an alarm at the OWS to indicate fire alarm status.
7. The following items shall be displayed at the OWS:
   a. Discharge air temperature.
   b. Return air temperature.
   c. Exhaust air temperature.
   d. Fire alarm system status alarm.

e. Commanded status of fans.

f. Supply fan operational status via a current sensor.

g. Exhaust fan operational status via a current sensor.

h. Heat pump cycle status

i. Heat pump coil discharge air temperature.

j. Diagram showing the layout of the equipment with major components and dynamic temperatures shown where temperature sensors exist in the system.

D. Variable Volume Refrigerant System – Control Air Cooled Condensing Unit (ACC-3) Branch Modules (MCU-1.1, 1.2) and Heat Pumps (HP-1 thru HP-8)

1. The equipment manufacturer shall furnish a complete microprocessor based system to control the air cooled condenser, Branch Circuit Modules and Heat pumps.

2. The unit manufacturer shall furnish an IP based BACnet interface module with will be installed and wired by the BAS contractor. Through this interface, the BAS shall have read/write access to all setpoints and read access to all monitored points for display and alarm generation at the Operator Workstation.

3. Each heat pump unit shall be furnished from the factory with a space mounted temperature sensor. The BAS contractor shall mount each space temperature sensor and wire it to the corresponding heat pump.

4. The BAS contractor shall furnish and install low voltage control cable from the air cooled condensing unit to each branch circuit module. The BAS contractor shall furnish and install low voltage control cable from each branch circuit module to its related heat pumps. The BAS contractor shall also mount and wire the centralized controller and BACnet interface. Wiring will be low voltage and will connect the above devices as detailed by the equipment manufacturer.

5. During the programmed occupied mode, the fan shall run and cycle with setpoint. The factory controller shall cycle the compressor and reversing valve to maintain heating and cooling setpoints. Heating and cooling setpoints as well as occupancy schedules shall be adjustable via the BAS Operator Workstation.

6. During the unoccupied mode, cycle fan with compressor to maintain unoccupied space temperature as required for energy conservation. Heating and cooling setpoints as well as occupancy schedules shall be adjustable via the BAS Operator Workstation

7. The BAS Operator Workstation shall generate an alarm whenever the space temperature is more than 2 degrees higher or lower than the programmed sepoint. pump discharge temperature sensor down stream of each heat pump.

8. ATC Subcontractor shall interlock the auxiliary drain pan water sensor to the respective indoor unit mounted above ceilings. The sensor shall be wired to de-energize the indoor unit if moisture is detected in the auxiliary drain pan. A remote alarm shall be annunciated upon activation through the ATC system.

9. The ATC subcontractor shall interlock the condensate pump safety switch (where provided) to the respective heat pump unit. The safety switch shall be wired to de-energize the heat pump unit in the case of pump malfunction. A local alarm shall be annunciated upon activation of pump safety switch.

10. The following items shall be displayed at the Operator's Terminal:
    a. Diagram showing the layout of the building floor plan showing the location of all heat pumps and space temperature sensors.
    b. Cooling and heating temperature setpoints.
    c. Occupied / unoccupied mode.
    d. Operational alarms and statuses available from the unit manufacturer's BACnet interface.

E. Air Cooled Condensing Unit (ACC-1) and Library Evaporator Coil

1. Connect replacement (relocated) condensing unit ACC-1/Library evaporator coil to existing controls. Verify all points of control.

F. Boiler/Burner Control

1. Connect existing control devices/interface with replacement burner management system. Coordinate with burner management system manufacturer for all required inputs/interface. Provide points and tie-ins or new and existing.

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 piping and 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 insure 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.

3.8 EXISTING CONTROLS

A. The bid for control work shall be based on the premise that existing control devices are operational and are not in need of repair or replacement unless otherwise noted.

B. Contractor shall notify the Owner of all control devices that need to be replaced or repaired that may be noticed by him in the process of installation of the new work.

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 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 Construction Manager at least three working days in advance of test and conduct in presence of 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 CIRCULATING WATER SYSTEM TEST

A. All piping tests shall be applied not only to piping, but also to all devices and equipment connected thereto with the exception of control valves, boilers or any other equipment which may be damaged by the test pressure. All valves shall be full open.

B. Test at 100 psi hydrostatic pressure for 6 hours:

1. Record pressures each hour
2. Repair all leaks
3. Retest until 6 hours can be completed with no leaks or loss of pressure.

C. After completion of successful test, strainers shall be cleaned, then system shall be backflushed and strainers cleaned again.

3.3 DRAINAGE AND CONDENSATE SYSTEMS TESTING (INCLUDING EXTERIOR PIPING)

A. Disconnect all equipment and devices which may be damaged by test pressures.

B. Plug or cap lines.

C. Test each piping system for leaks in accordance with local inspection test code.

D. Repair all leaks noted.

E. Minimum test shall be to fill system to top vent stack and roof drain, and not show a drop of more than 3 inches for 1 hour. Test shall be performed before piping is concealed.

F. Secure certificate from Municipal Inspector of acceptable test.

3.4 DOMESTIC WATER & MAKE-UP WATER PIPING TESTING (INCLUDING EXTERIOR PIPING)

A. Test domestic water piping at 10 psig hydrostatic pressure for 4 hours. Drop in pressure shall not be greater than 1 psig. Use gauge calibrated in one pound increments. If test is under the jurisdiction of local inspector, his requirements may be used provided they are not less than above. Furnish signed report of test and witness.

3.5 DUCTWORK TESTING

A. Witness testing conducted by the Mechanical Contractor per Section 23 0600, PART 3: EXECUTION.

3.6 STEAM SYSTEM TEST

A. All piping tests shall be applied, only to piping. Piping test shall be made after piping is hung, supported, anchored and guided, and before insulation is applied. When leaks occur in the system, the leaks shall be repaired and retested until no leaks are present. Do not apply test pressures to control valves, coils or traps.

B. Low pressure steam and condensate piping shall be hydrostatically tested at 100 psig and with steam at 15 psig.

C. After the steam test is completed, all safety valves, strainers, traps, etc., shall be cleaned of foreign matter and the system shall be operated to prove a positive and quiet steam system circulation.

3.7 FUEL OIL SYSTEM TEST

A. All piping tests shall be applied only to piping. Piping test shall be made after all piping is hung, supported, anchored, and guided. When leaks occur in the system, the leaks shall be repaired and retested until no leaks occur.

B. All piping shall be tested under pressure or vacuum in accordance with the appropriate articles in NFPA Standards 30 and 31 that govern the installation.

C. All piping tests shall be witnesses by the Construction Manager and the Owner's Representative. A written record of the test results and witnesses shall be submitted to the Engineer.

3.8 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 and condenser 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