

Project Manual For

Replacement Facility for Wrangell Medical Center

Volume 3 – Architectural & MPE
Architect's Project No. 10528.00

Wrangell, Alaska

April 23, 2012

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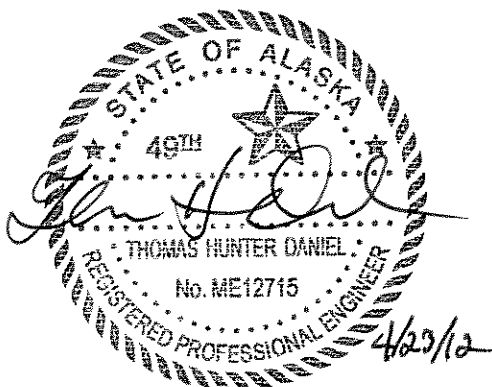
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Sections are denoted below by a CM for Construction Manager and/or a CC for Component Contract to distinguish between scope of work. Should a section denote both a CM/CC, refer to specification section and construction drawings for separation of scope.

DIVISION 0 - BIDDING REQUIREMENTS

Refer to Construction Manager and Project Manager's Bid Packages, attached to these documents.

DIVISION 1 - GENERAL REQUIREMENTS

CM/CC	01-1100	Summary of Work (<i>Archt</i>)
CM/CC	01-2000	Price and Payment Procedures (<i>Archt</i>)
CM/CC	01-2100	Allowances (<i>Archt</i>)
CM/CC	01-2513	Product Substitution Procedures (<i>Archt</i>)
CM/CC	01-2513.13	Substitution Request Form (<i>Archt</i>)
CM/CC	01-2600	Contract Modification Procedures (<i>Archt</i>)
CM/CC	01-3119	Project Meetings (<i>Archt</i>)
CM/CC	01-3200	Construction Progress Documentation (<i>Archt</i>)
CM/CC	01-3323	Shop Drawings, Product Data, Samples (<i>Archt</i>)
CM/CC	01-4000	Quality Requirements (<i>Archt</i>)
CM/CC	01-4517	Uncovering and Correction of Work (<i>Archt</i>)
CM/CC	01-4529	Testing Laboratory Services (<i>Archt</i>)
CM/CC	01-5000	Temporary Facilities and Controls (<i>Archt</i>)
CM/CC	01-6500	Product Delivery Requirements (<i>Archt</i>)
CM/CC	01-6600	Product Storage and Handling Requirements (<i>Archt</i>)
CM/CC	01-7329	Cutting And Patching (<i>Archt</i>)
CM/CC	01-7400	Cleaning and Waste Management (<i>Archt</i>)
CM/CC	01-7700	Closeout Procedures (<i>Archt</i>)
CM/CC	01-7823	Operation and Maintenance Data (<i>Archt</i>)
CM/CC	01-7833	Product Warranties and Bonds (<i>Archt</i>)
CM/CC	01-7839	Project Record Documents (<i>Archt</i>)
CM/CC	01-7841	Spare Parts and Maintenance Materials (<i>Archt</i>)

DIVISION 4 - MASONRY

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DIVISION 5 - METALS

CC	05-4100	Structural Metal Stud Framing (<i>Archt</i>)
CC	05-4523	Healthcare Metal Supports (<i>Archt</i>)
CM/CC	05-5000	Metal Fabrications (<i>Archt</i>)

DIVISION 6 - WOOD, PLASTICS AND COMPOSITES

CC	06-1000	Rough Carpentry (<i>Archt</i>)
CC	06-1643	Gypsum Sheathing (<i>Archt</i>)
CC	06-2000	Finish Carpentry (<i>Archt</i>)
CM	06-4013	Exterior Architectural Woodwork (<i>Archt</i>)
CC	06-4023	Interior Architectural Woodwork (<i>Archt</i>)



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CC	07-2726	Fluid Applied Air & Water Barrier (<i>Arch.</i>)
CM	07-4113	Metal Roof Panels (<i>Arch.</i>)
CC	07-4646	Fiber Cement Siding (<i>Arch.</i>)
CC	07-5300	Elastomeric Membrane Roofing (<i>Arch.</i>)
CM/CC	07-6207	Shop-Fabricated Sheet Metal Accessories and Trim (<i>Arch.</i>)
CM/CC	07-6507	Flashing (<i>Arch.</i>)
CC	07-7233	Roof Hatches (<i>Arch.</i>)
CC	07-8400	Firestopping (<i>Arch.</i>)
CC	07-9200	Joint Sealants (<i>Arch.</i>)
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CC	09-6513.13	Resilient Bases (<i>Arch.</i>)
CC	09-6516	Resilient Sheet Flooring (<i>Arch.</i>)
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CC	09-6727	Epoxy Polymer Flooring System
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CC	10-2623.13	Impact-Resistant Wall Protection (<i>Arch.</i>)
CC	10-2813	Toilet Accessories (<i>Arch.</i>)
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CC	10-5113	Metal Lockers (<i>Arch.</i>)
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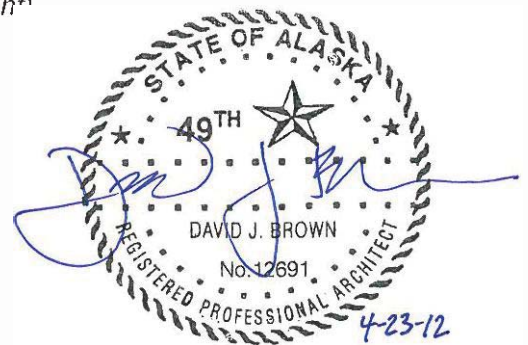


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DIVISION 13 - SPECIAL CONSTRUCTION

CC 13-4900 Radiation Protection (*Arch*)

DIVISION 21 - FIRE SUPPRESSION

CC 21-0500 Fire-suppression Piping (*Plumb*)

DIVISION 22 - PLUMBING

CC 22-0100 Plumbing General Provisions (*Plumb*)

CC 22-0110 Hangers & Supports for Plumbing (*Plumb*)

CC 22-0523 General Duty Valves (*Plumb*)

CC 22-0700 Plumbing Piping Insulation (*Plumb*)

CC 22-1100 Domestic Water Piping (*Plumb*)

CC 22-1119 Plumbing Specialties (*Plumb*)

CM/CC 22-1316 Sanitary Waste & Vent Piping (*Plumb*)

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CC 23-0100 HVAC General Provisions (*Mech*)

CC 23-0104 HVAC Basic Materials & Methods (*Mech*)

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CC 23-0593 Testing, Adjusting, & Balancing (*Mech*)

CC 23-0713 Duct Insulation (*Mech*)

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CC 23-0963 Building Automation Systems (*Mech*)

CC 23-2113 Hydronic Piping & Pipe Fittings (*Mech*)

CC 23-2114 Hydronic Piping Valves (*Mech*)

CC 23-2115 Hydronic Specialties (*Mech*)

CC 23-2123.13 Inline Centrifugal Hydronic Pumps (*Mech*)

CC 23-2123.26 End Suction Pumps, Centrifugal Hydronic Pumps (*Mech*)

CC 23-2300 Refrigerant Piping (*Mech*)

CC 23-2500 Water Treatment for HVAC Systems (*Mech*)

CC 23-3113.23 Low Pressure Ductwork (*Mech*)

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CC 23-3300 Sheet Metal Accessories (*Mech*)

CC 23-3416.26 High Plume Isolation Room Fans (*Mech*)

CC 23-3423 Power Roof Ventilators & Exhausters (*Mech*)

CC 23-3613 Variable & Constant Volume Boxes (*Mech*)

CC 23-3733 Louvers (*Mech*)

CC 23-3813.13 Kitchen Exhaust Hoods & Ductwork (*Mech*)

CC 23-4113 Filters (*Mech*)

CC 23-6213 Air Cooled Chiller (*Mech*)

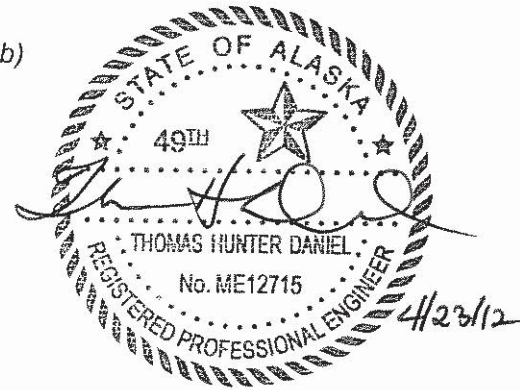
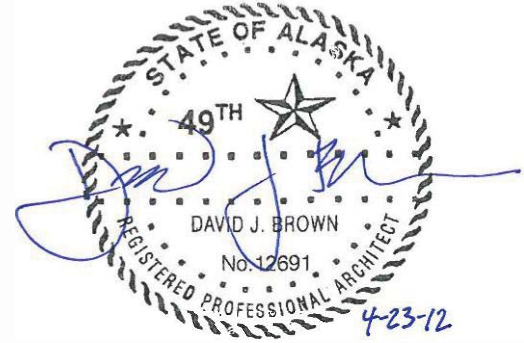
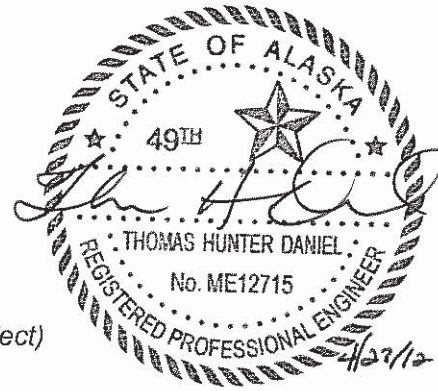


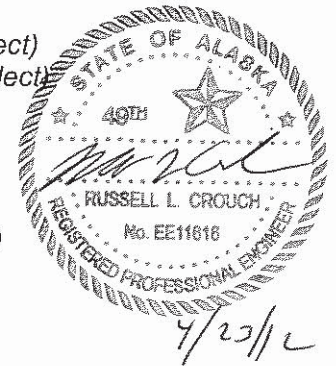
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CC	23-7443	Roof Curbs (<i>Mech</i>)
CC	23-8123.16	Small Computer Room AC Units (<i>Mech</i>)
CC	23-8127	Ductless Split Systems (<i>Mech</i>)
CC	23-8239	Electric Unit Heater (<i>Mech</i>)
CC	23-8413	Humidifiers (<i>Mech</i>)



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CC	26-0500	Common Work Results from Electrical (<i>Elect</i>)
CC	26-0510	Motor Starters/Mech. Equipment Connection (<i>Elect</i>)
CC	26-0519	Electrical Power Conductors and Cable (<i>Elect</i>)
CC	26-0522	Flexible Metal Conduit (<i>Elect</i>)
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CC	26-0532	Raceways for Electrical Systems (<i>Elect</i>)
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CC	26-4100	Lightning Protection System (<i>Elect</i>)
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SECTION 01-1100
SUMMARY OF WORK

PART 1 - GENERAL

1.1 PROJECT DESCRIPTION

- A. The Project consists of two separate contracts for construction.
- B. Layton Construction shall act as the Construction Manager and shall be responsible for the bidding and awarding of the following scope to subcontractors:
 - 1. All site work including underground utilities, rough and final grading, all foundations, a 2 hour independent fire wall, building canopies, asphalt and concrete paving, curbs, landscaping, and signage as shown on Contract Documents prepared by David E. Johnson Architect, dated March 21, 2012 and March 28, 2012.
- C. The Owner shall work with the Construction Manager to bid and award the following scope to a Component Contractor:
 - 1. Construction including delivery and installation of a 55,000 square foot one story hospital built using a component construction method, as shown on the Contract Documents prepared by David E. Johnson Architect, dated April 23, 2012. Scope shall include the tie in of all utilities and structural connections between components and work being performed by the Construction Manager.
- D. This contract is expected to be funded in whole or in part using funds from the American Recovery and Reinvestment Act (ARRA). Section 1605 of the ARRA prohibits the use of these funds unless all iron, steel, and manufactured goods are produced in the United States. All iron and steel manufacturing processes must take place in the United States, except for metallurgical processes involving refinement of steel additives. There is no requirement for the origin of components and subcomponents of manufactured goods. Products listed at 48 CFR 25.104(a) have been determined to be unavailable in the United States and if required for the project may be purchased from foreign sources. No unauthorized use of foreign iron, steel, and/or manufactured goods will be allowed on this project.

1.2 REPORTS AVAILABLE TO THE CONTRACTOR

- A. Geotechnical Report:
 - 1. Sub-surface investigation has been performed at the project site. This investigation was conducted, and a report obtained, solely for design purposes and is not a part of the Contract Documents.
 - 2. The use and interpretation of this information will be entirely the responsibility of the using party. The Owner is not responsible for variations in the sub-surface conditions. Bidders shall decide for themselves the character of the material to be encountered.
 - 3. The report of the subsurface soil investigation by an independent testing laboratory is available upon request from the Owner for use and reference during construction. Reference the geotechnical report by R&M Engineering dated December 15, 2010. Copies are available upon request.

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- B. Shielding Report:
 - 1. A report of the anticipated radiation shielding protection required for the project shall be completed prior to construction to confirm the extent of lead lining shown on the contract documents.

1.3 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.
- B. Work shall be performed in a manner that will not impose avoidable hardship, danger, or inconvenience to public or surrounding neighbors.

1.4 USE OF PREMISES

- A. Use of Site: Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed without written approval of Owner.
 - 1. Obtain written approval from Owner at least seven (7) working days in advance when scheduling Work outside limits of construction. Provide Owner an estimate of time needed to perform Work outside limits of construction.
 - 2. Cutting, capping, and reconnecting utility systems outside limits of construction shall be performed by Contractor, unless otherwise noted.
 - 3. Conform to all laws, ordinances, permits and regulations affecting the Work on site.
 - 4. Existing roads, streets, drives, parking lots, entrances and required fire exitways serving the premises shall be kept clear and available at all times for their intended use. These areas shall not be used for parking, staging or storage without the Owner's written approval. Coordinate with Owner, and provide alternate routes for public and Owner access if normal routes are affected. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
 - 5. Do not unreasonably encumber site with equipment, materials, or vehicles.
 - 6. Return all improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed; to conditions which existed previous to starting performance under the Contract.
 - 7. Construction personnel will not at any time park in any Owner parking lot, on Owner property without Owner's consent, and will not park on adjacent residential streets.

1.5 PARTIAL OWNER OCCUPANCY

- A. General: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building, prior to Substantial Completion provided that such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.
 - 2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.

3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.6 OWNER-FURNISHED ITEMS

- A. The Owner will provide items indicated to be furnished by Owner in the Contract Documents. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.
 1. The Owner will arrange and pay for delivery of Owner-furnished items in accordance with the Contractor's Construction Schedule, and will inspect deliveries for damage.
 2. If Owner-furnished items are damaged, defective or missing, the Owner will arrange for replacement. The Owner will also arrange for manufacturer's field services, and the delivery of manufacturer's warranties and bonds to the Contractor.
 3. The Contractor is responsible for designating the delivery dates of Owner-furnished items in the Contractor's Construction Schedule and for receiving, unloading and handling Owner-furnished items at the site. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements, and to repair or replace items damaged as a result of his operations.

1.7 MISCELLANEOUS PROVISIONS

- A. By execution of this Contract, Contractor acknowledges review of proposed details and specifications and agrees to provide warranties and bonds for products and systems specified herein, detailed on drawings and as approved as a substituted or equal product or system in Section 01-2513.
- B. No material containing asbestos shall be used in the construction of this project or incorporated into the completed work. Contractor shall provide certification that the building is asbestos free at the completion of construction, as required in Contract Closeout, Section 01-7700.

1.8 COORDINATION

- A. Coordinate work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
- B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

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- D. Execute cutting and patching to integrate elements of Work, uncover ill-timed, defective, and non-conforming Work, and provide samples for testing if required. Seal penetrations through floors, walls, and roofing.

1.9 DEFINITIONS AND EXPLANATIONS

- A. Imperative language is used generally in the specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor as if preceded by the phrase “The Contractor shall”.
- B. The term “provide” means furnish and install, complete, and ready for intended use.
 - 1. Except as otherwise defined in greater detail, the term “furnish” means supply and deliver to the project site, including unloading, unpacking, inspecting, and storing until ready for receipt by Owner, installation, etc., as applicable.
 - 2. Except as otherwise defined in greater detail, the term “install” is used to describe operations at project site including assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations, as applicable.
- C. The term “indicated” is used as cross-reference to graphics, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as “shows”, “noted”, “schedules”, and “specified” are used in lieu of “indicated”, it is for purpose of helping reader locate cross-reference, and no limitations of location is intended.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01-2000
PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Procedural requirements for processing the following:
 - 1. Schedule of Values.
 - 2. Cash flow projections for the project.
 - 3. Payment applications.
 - 4. Payments at substantial completion.
 - 5. Payment at final completion.
 - 6. Identification of substitutions and alternatives in payment requests.
 - 7. Accounting of Change Order amounts and allowances, and similar cost and pay-out related requirements.

1.2 SCHEDULE OF VALUES

- A. General:
 - 1. Prepare typed schedule on AIA Form G703-1992, in coordination with the preparation of the progress schedule.
 - 2. Correlate the line items of the Schedule of Values with other administrative schedules and forms required for the work, including the following:
 - a. Progress schedule.
 - b. Payment request form.
 - c. Listing of subcontractors.
 - d. Schedule of allowances.
 - e. Schedule of alternates.
 - f. Listing of products and principal suppliers and fabricators.
 - g. Schedule of submittals.
 - 3. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of payment requests and progress reports.
 - 4. A breakdown of principal subcontract amounts will be required (several line items).
 - 5. At Contractor's option, values may be rounded off to nearest whole dollar, but total must equal the Contract Sum.
- B. Material/Fabrication Values: For each unit of work where payment requests will be made on account of materials or equipment purchased/fabricated/delivered but not yet installed, show "initial value" for payment request and "value added" for subsequent stage or stages of completion on that unit of work.
- C. Time Coordination: In the coordination of initial submittals and other administrative "start-up" activities, submit the Schedule of Values to the Architect no later than 7 days before the initial payment application is to be submitted.
- D. Listing: Arrange schedule with columns to indicate the generic name of the item, related specification sections, subcontractor, supplier/manufacturer/fabricator, Change Order (numbers) which have affected the value, dollar value of item, and percentage of Contract Sum (to nearest one-hundredth percent and adjusted to total 100 percent).
- E. Schedule Updating:

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1. Update and resubmit Schedule of Values whenever Change Orders affect the listing and whenever the actual performance of the work involves necessary changes of substance to the values previously listed.
2. Coordinate re-submittal times with progress reports and payment application.

1.3 PAYMENT APPLICATIONS

A. General:

1. Except as otherwise indicated in the Contract Documents, comply with the procedures and requirements of the General Conditions, including the submittal of supporting documentation and waivers or releases of lien.
2. Refer to General Conditions of the Contract, Supplementary Conditions for requirements concerning "retainage" by Owner on payment.
3. Except as otherwise indicated, sequence of progress payments shall be made on a regular basis, and each must be consistent with previous applications and payments.

B. Payment Application Times: The period of construction work covered by each payment request is the period indicated in the General Conditions of the Contract and Supplementary Conditions.

C. Application Preparation:

1. Payment Application Forms: AIA Document G702-1992 and Continuation Sheets.
2. Except as otherwise indicated, complete every entry provided for on the form, including the notarization and execution by authorized persons.
3. Incomplete applications shall be returned by the Architect without action.
4. Entries must match current data of both the Schedule of Values and progress schedule and report.
5. Listing must include amounts of Change Orders approved prior to the last day of the "period of construction" of the application.

D. Stored Materials: Include in Payment Application amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner and consent of surety to payment, for stored materials.
2. Provide supporting data that verifies amount requested, such as invoices.
3. Provide summary of stored materials indicating:
 - a. Materials previously stored and included in previous Payment Applications
 - b. Work completed for this Payment Application utilizing previously stored materials.
 - c. Additional materials stored with the Payment Application.
 - d. Total materials remaining stored, including materials with the Payment Application.

E. Initial Payment Application: The following must be received by the Architect prior to submittal of the first payment application.

1. Listing of subcontractors and principal suppliers and fabricators.
2. Schedule of values.
3. Progress schedule.
4. Schedule of principal products.

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5. Schedule of unit prices.
 6. Schedule of submittals.
 7. Listing of Contractor's staff assignments and principal consultants.
 8. Copies of acquired building permits and similar authorizations and licenses from governing authorities for the current performance of the work.
 9. Data needed by Owner to acquire insurance coverage required of the Owner.
 10. Initial settlement survey and damage report, if required.
 11. Initial progress report, including report of preconstruction meeting.
- F. Application at Time of Substantial Completion:
1. Following the issuance of the Architect's "Certificate of Substantial Completion", and also in part as applicable to prior certificates on portions of completed work as designated, a "special" payment application may be prepared and submitted by the Contractor.
 2. The principal administrative actions and submittals which must precede or coincide with such special applications are specified in the General Conditions, and elsewhere in the Contract Documents.
 3. Those specifically related to the application can be summarized as follows, but not limited to these:
 - a. Occupancy permits and similar approvals or certifications by governing authorities and franchised services, assuring Owner's full access and use of the completed work.
 - b. Warranties, guarantees, maintenance agreements and similar provisions of the Contract Documents.
 - c. Test/adjust/balance records, maintenance instructions, meter readings, start-up performance reports, and similar change-over information germane to the Owner's occupancy, use, operation and maintenance of the completed work.
 - d. Final cleaning of the work.
 - e. Application for reduction (if any) of retainage, and Consent of Surety.
 - f. Advice to Owner on coordination of shifting insurance coverage, including proof of extended coverage as required.
 - g. Final progress photographs, if required.
 - h. Listing of incomplete work (Punch List) recognized to be completed by the Contractor, as exceptions to the Architect's Certificate of Substantial Completion.
- G. Final Payment Application:
1. The administrative actions and submittals which must proceed or coincide with submittal of the final payment application can be summarized as follows, but not necessarily limited to these:
 - a. Completion of project closeout requirements.
 - b. Completion of items specified for payment application at time of substantial completion (regardless of whether such application was made).
 - c. Assurance, satisfactory to Owner, that unsettled claims will be settled and that work not actually completed and accepted will be completed without undue delay.
 - d. Transmittal of required project construction record documents and materials to Owner.
 - e. Certified property survey.
 - f. Proof, satisfactory to Owner, that taxes, fees and similar obligations of the Contractor have been paid.
 - g. Removal of temporary facilities, services, surplus materials, rubbish and

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similar provisions.

- h. Change over of door locks and other Contractor access to Owner's property.
- i. Consent of Surety for Final Payment.

H. Application Transmittal:

- 1. Submit number of copies to be verified at first Owner/Architect/Contractor meeting. Include with one copy waivers of lien and similar attachments.
- 2. Transmit each copy with a transmittal form listing those attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.
- 3. Transmit to Architect to ensure receipt within 24 hours.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01-2100
ALLOWANCES

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Requirements for the following allowances:
 - 1. Lump-sum cash allowances.
 - B. Certain requirements of the Work related to each allowance are shown and specified in the Contract Documents.
 - C. The allowance has been established in lieu of additional requirements for that work; further requirements (if any) will be issued by Change Order.
- 1.2 SELECTING AND PURCHASING
 - A. At the earliest feasible date after the award of Contract, the Architect/Engineer must be advised of the scheduled date when the final selection and purchase of each product or system described by each allowance will be accomplished in order to avoid delays in the performance of the Work.
 - B. Obtain and submit proposals for the work of each allowance, as requested by the Architect/Engineer for use in making final selections. Include whatever recommendations for selection that may be important for proper performance of the Work.
 - C. Purchase the products and systems as specifically selected (in writing) by the Architect/Engineer.
 - D. Submit proposals and recommendations for the purchase of products or systems described by each allowance in accordance with "Change Order Requirements" specified in this Section.
- 1.3 CASH ALLOWANCE
 - A. Comply with the General Conditions for the cash allowances enumerated below.
 - B. Schedule of Lump-Sum Allowances (to be carried by the Construction Manager):
 - 1. Lump-Sum Allowance: Allow the lump-sum of \$25,000 for the purchase and delivery of Landscaping to be specified and detailed at a later date.
 - 2. Lump-Sum Allowance: Allow the lump-sum of \$50,000 for the purchase and delivery of Interior and Exterior Signage to be specified and detailed at a later date.

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PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01-2513
PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements for requesting approval of proposed substitutions.
- B. The requirements of this section govern the use of "Substitution Request Form - Section 01-2513.13".

1.2 SUBSTITUTION CLAUSE

- A. When a material, article, or piece of equipment is identified on the drawings or in the specifications by reference to manufacturer's or vendor's name, trade name, catalog number, or the like, it is only identified to establish a standard. Within the specifications, two other manufacturers are listed as "approved equals" and are not required to be submitted for additional approval. A substitution request shall be made in the event there is a material, article, or piece of equipment of other manufacturers or vendors that will perform, equally or better, the duties imposed by the general design. The request will then be considered equally acceptable provided the proposed items are, in the opinion of the architect, of equal substance, appearance, and function. These items shall not be purchased or installed by the Contractor without the Architect's written approval. As part of the approval process the proposed brand name products must meet ARRA requirements before concurring that they are otherwise acceptable. Therefore bidders and contractors shall submit a certification that proposed substitutes and equals meet ARRA requirements with any such submittal.

1.3 LIMITATIONS ON SUBSTITUTIONS

- A. Substitutions will not be considered unless the "Substitution Request Form - Section 01-6325" attached in this Project Manual is used and the requirements of this section and Section 01-6325 are fully complied with.
 - 1. Other types of forms are not acceptable.
- B. Substitutions will not be considered when indicated on shop drawings or product data submittals without separate formal request complying with "submittal procedures" specified in this section.
- C. Substitutions will not be considered unless submitted through the General Contractor.
- D. Additional studies, investigations, submittals, redesign and/or analysis by the Architect/Engineer caused by the requested substitutions shall be paid by the Contractor at no expense to the Owner.
- E. Substitute products shall not be ordered or installed without written acceptance.
- F. Only one request for substitution for each product will be considered. When substitution is not accepted by the Architect, provide the specified product.
- G. Architect will determine the acceptability of all substitutions.

PRODUCT SUBSTITUTION PROCEDURES 01-2513-2
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1.4 REQUESTS FOR SUBSTITUTIONS

- A. Contractor's Representation:
 - 1. Request for substitution constitutes a representation that the Contractor:
 - a. Has investigated the proposed product and has determined; that it is equal to or superior in all respects to the specified product.
 - b. Will provide same type of warranty for substitution as for specified product.
 - 1) Contractor's warranty shall be in writing guaranteeing all substituted products have same or superior performance as the product specified.
 - c. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
 - d. Waives all claims for additional costs related to substitutions which consequently become apparent.
 - e. Has thoroughly investigated the proposed substitute to determine if license fees and royalties are pending on the proposed substitute, for compliance with General Conditions of the Contract.
 - f. That the proposed substitute meets ARRA requirements.
 - 2. Request for substitution constitutes a representation that the cost data is complete and includes all related cost under his Contract, but excludes any approved Architect's design fees required by substitution.
- B. Requests for substitutions shall be submitted on "Substitution Request Form - Section 01-2513.13" within one week of the designated bid date. Legible copies of this form shall be made as required for Contractor's submittals. Each submittal request form shall be complete with data substantiating compliance of proposed substitution with requirements of Contract Documents.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SUBSTITUTION REQUEST FORM 01- 2513.13-1
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SECTION 01-2513.13
SUBSTITUTION REQUEST FORM

ARCHITECT/ENGINEER WILL NOT REVIEW THIS FORM UNLESS COMPLETELY FILLED OUT INCLUDING SALIENT CHARACTERISTICS COMPARISON.

Project: Replacement Hospital for Wrangell Medical Center, Wrangell, Alaska

Submit to: Julia M. Covington
Johnson Johnson Crabtree Architects P.C.
Nashville, TN 37204
Fax: 615-837-0657
Email: jcovington@jjca.com

Date Submitted: _____

Specification Section No. and Title _____ - _____

Specified Item: _____

Paragraph No. (Example 2.3.A.) _____

Proposed Substitute: _____

Substitute Manuf. website/Direct link to product: _____

1. How will dimensions, gauges, and weights indicated in Contract Documents be changed by proposed substitute? _____

2. How will wiring, piping, and duct work indicated in Contract Documents be changed by proposed substitute? _____

3. How will other trades be effected by proposed substitute? _____

4. How will the construction schedule be effected by the proposed substitute? _____

5. How will the proposed substitute change unit costs? Circle and complete one below: No change. Cost will decrease by _____. Cost will increase by _____.

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Provide breakdown for cost changes on attached sheet.

6. How will the manufacturers warranty of proposed substitute differ from warranty indicated in Construction Documents?

7. Provide a point-by-point comparison of the important salient characteristics of proposed substitute against the specified item. Attach additional pages as needed. Do not leave this section blank or use words like “no difference” or “None”.

Specified Item	Proposed Item
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>

8. Subcontractor Company Name: _____
Company Representative: _____
Telephone Number _____ email address _____

9. The undersigned makes the following certifications:
- a. The proposed substitution has been fully investigated and determined to have overall performance and longevity equal or superior to the specified product.
 - b. That cost data is complete and that no claim for additional cost will be made after Substitution Request is accepted.
 - c. That coordination, installation and changes associated with substitution will be complete.

General Contractor Company Name: _____
Company Representative: _____
Address: _____
Telephone Number _____ Fax Number _____
Signature & Date: _____

SUBSTITUTION REQUEST FORM 01- 2513.13-3
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10. Architects Acceptance

Accepted _____ Accepted as noted _____ Rejected (See comment below) _____

Comment _____

Architect' Signature & Date: _____

SECTION 01-2600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Procedural requirements for considering and processing Change Orders.
- B. Related Requirements:
 - 1. Agreement: The amounts of established unit prices.
 - 2. Conditions of the Contract:
 - a. Methods of determining cost or credit to Owner resulting from changes in Work made on a time and material basis.
 - b. Contractor's claims for additional costs.
 - 3. Section 01-2100: Allowances.
 - 4. Section 01-2000: Price And Payment Procedures
 - 5. Section 01-7839: Project Record Documents.
- C. Forms for Changes: See Section 00-5000.

1.2 PROPOSAL PROCEDURES

- A. Owner or Architect may initiate a potential change by submitting a Proposal Request or Supplemental Instructions to Contractor. Request will include the following:
 - 1. Detailed description of the Change, Products, and location of the change in the Project.
 - 2. Supplementary or revised Drawings and Specifications.
 - 3. The projected time span for making the change and a specific statement as to whether overtime work is, or is not, authorized.
 - 4. A specific period of time during which the requested price will be considered valid.
 - 5. Such request is for information only, and is not an instruction to execute the changes, or to stop Work in progress.
- B. Contractor may initiate a request for changes by submitting a written notice to Architect, containing the following:
 - 1. Description of the proposed changes.
 - 2. Statement of the reason for making the changes.
 - 3. Statement of the effect on the Contract Sum and the Contract Time.
 - 4. Statement of the effect on the work of separate contractors.
 - 5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.
- C. Provide full written data required to evaluate changes.
 - 1. Maintain detailed records of work performed on a time-and-material/force account basis.
 - 2. Provide full documentation to Architect upon request.
- D. Designate in writing the member of Contractor's organization:
 - 1. Who is authorized to accept changes in the Work.
 - 2. Who is responsible for informing others in the Contractor's organization of the authorization of changes in the Work.

CONTRACT MODIFICATION PROCEDURES 01-2600-2
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- E. Owner will designate in writing the person who is authorized to execute Change Orders.

1.3 CONSTRUCTION CHANGE DIRECTIVES

- A. In absence of total agreement on the terms of a Change Order, the Architect may prepare and issue a Construction Change Directive directing a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive will describe changes in the Work and describe the method of determining any change in the Contract Sum or Contract Time, or both.
 - 2. Construction Change Directive will be signed by Owner and Architect.
- B. Upon receipt of a Construction Change Directive, Contractor shall do the following:
 - 1. Promptly proceed with the change in the Work involved.
 - 2. Promptly advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.
- C. A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them.
 - 1. Such agreement shall be effective immediately and shall be recorded as a Change Order.
 - 2. If Contractor does not respond promptly or disagrees with the Construction Change Directive, he shall comply with General Conditions.
- D. A Construction Change Directive shall be processed in compliance with requirements of the General Conditions.

1.4 DOCUMENTATION OF PROPOSALS AND CLAIMS

- A. Support each quotation for a lump-sum proposal, and for each unit price which has not previously been established, with sufficient substantiating data to allow Architect to evaluate the quotation.
- B. On request provide additional data to support time and cost computations:
 - 1. Labor required.
 - 2. Equipment required.
 - 3. Products required:
 - a. Recommended source of purchase and unit cost.
 - b. Quantities required.
 - 4. Taxes, insurance and bonds.
 - 5. Credit for work deleted from Contract, similarly documented.
 - 6. Overhead and profit, for subcontractor and General Contractor separately.
 - 7. Justification for any change in Contract Time.
- C. Support each claim for additional costs, and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal, plus the following additional information:
 - 1. Name of the Owner's authorized agent who ordered the Work, and date of the order.
 - 2. Dates and hours work was performed, and by whom.
 - 3. Time record, summary of hours worked, and hourly rates paid.

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- 4. Receipts and invoices for:
 - a. Equipment used, listing dates and times of use.
 - b. Products used, listing of quantities.
 - c. Subcontracts.
 - d. Overhead and Profit, Taxes, Insurance.
 - D. Document requests for substitutions for Products as specified elsewhere in Division 1.
- 1.5 PREPARATION OF CHANGE ORDERS
- A. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.
 - B. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.
- 1.6 LUMP-SUM/FIXED PRICE CHANGE ORDER
- A. Content of Change Orders will be based on, either:
 - 1. Architect's Proposal Request and contractor's responsive Proposal as mutually agreed between Owner and Contractor.
 - 2. Contractor's Proposal for a change, signed by the Contractor, as recommended by Architect.
 - B. Owner and Architect will sign and date the Change Order as authorization for the Contractor to proceed with the changes, after the Contractor has signed the Change Order.
- 1.7 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION CHANGE AUTHORIZATION
- A. Architect or Owner will issue a Construction Change Directive directing Contractor to proceed with the changes.
 - B. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.
 - C. Architect will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.
 - D. Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.
- 1.8 CORRELATION WITH CONTRACTOR'S SUBMITTALS
- A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work, and to record the adjusted Contract Sum.
 - B. Periodically revise the Construction Schedule to reflect each change in Contract Time.
 - 1. Revise sub-schedules to show changes for other items of work affected by the changes.

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- C. Upon completion of Work under a Change Order, enter pertinent changes in Record Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOTE USED.

END OF SECTION

SECTION 01-3119
PROJECT MEETINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Contractor's Responsibilities:
 - 1. Schedule and administer meetings throughout duration of work.
 - 2. Prepare agenda for meetings.
 - 3. Distribute written notice of each meeting seven working days in advance of meeting date.
 - 4. Make physical arrangements for meetings.
 - 5. Preside at meetings.
 - 6. Record the minutes; include all significant proceedings and decisions.
 - 7. Reproduce and distribute copies of minutes within three working days after each meeting.
 - 8. Provide one copy to:
 - a. All participants in the meeting, including the Architect.
 - b. All parties affected by decisions made at the meeting.

- B. Participants:
 - 1. Qualified representative of Contractors, Subcontractors, and Suppliers authorized to act on behalf of the parties they represent.
 - 2. Owner's Representative at their option.

1.2 PRE-CONSTRUCTION MEETING

- A. Schedule meeting within the early stages of Construction as determined by the General Contractor.

- B. Suggested Agenda: Prepare written material, distribute lists, and discuss the following:
 - 1. Identification of major Subcontractors and Suppliers.
 - 2. Projected construction schedules.
 - 3. Critical work sequencing.
 - 4. Major equipment deliveries and priorities.
 - 5. Project coordination, including designation of responsible persons.
 - 6. Procedures for, and processing of:
 - a. Field decisions.
 - b. Proposal requests.
 - c. Submittals.
 - d. Change orders.
 - e. Applications for payments.
 - 7. Adequacy of distribution of Contract Documents.
 - 8. Procedures for Maintaining Record Documents.
 - 9. Use of premises:
 - a. Office, work and storage areas.
 - b. Owner's requirements.
 - c. Construction facilities, construction aids, and controls.
 - d. Procedures for preventing interaction of hazardous roof materials with HVAC intakes.

- e. Temporary utilities.
- f. Safety and first aid procedures.
- g. Security procedures.
- h. Smoking policy.
- i. Housekeeping procedures.
- j. Working days/hours.

1.3 PROGRESS MEETINGS

- A. Schedule regular monthly meetings and as necessary, schedule additional meetings.
- B. Suggested Agenda:
 - 1. Review and approval of minutes of previous meeting.
 - 2. Review of work progress since previous meeting.
 - 3. Field observations, problems, conflicts.
 - 4. Problems which impede construction schedule.
 - 5. Review of off-site fabrication, delivery schedules.
 - 6. Corrective measures and procedure required to regain projected schedule.
 - 7. Revisions to construction schedule.
 - 8. Plan progress and schedule for succeeding work period.
 - 9. Coordination of schedules.
 - 10. Review submittal schedules; expedite as required.
 - 11. Maintenance of quality standards.
 - 12. Review proposed changes for:
 - a. Effect on construction schedule and on completion date.
 - b. Effect on other contracts of the Project.
 - 13. Other business.

1.4 PRE-INSTALLATION MEETINGS

- A. Notify Architect ten working days before meeting date.
- B. Envelope and Roofing Pre-Installation Conference:
 - 1. Prior to starting roofing and exterior envelope work, the Contractor shall set up a job site meeting with the following attendees:
 - a. Contractor's Project Manager and Project Superintendent
 - b. Architect's Representative
 - c. Subcontractors responsible for portions of the Work associated with the building envelope and roof, including the following as applicable to the project: Masonry, fiber cement siding, exterior studs, exterior sheathing and vapor retarder, windows, through-wall flashing, sealants, roofing (insulation, lightweight concrete, roofing material), metal flashing/ fascia, roof drains, mechanical roof equipment, and any other subcontractors the general contractor feels need to be present for the discussion.
 - d. Manufacturers representatives for portions of the Work associated with the building envelope and roof, including the following as applicable to the project: Brick, fiber cement siding, exterior studs, exterior sheathing, flashing, sealants, roofing, and any other subcontractors the General Contractor feels need to be present for the discussion.
 - 2. Agenda: Review submittals, project specifications, pertinent details, testing requirements, and design intent.

3. Recording: The Contractor shall record discussions of conference and decisions reached, and furnish copy of record to each attendee.
- C. Door Hardware Pre-Installation Conference:
1. Prior to starting door hardware installation, the General Contractor shall set up a job site meeting with the following attendees:
 - a. General Contractor's Project Manager and Project Superintendent
 - b. Architect's Representative
 - c. Subcontractors responsible for portions of the Work associated with the door hardware installation, including the following as applicable to the project: Door Hardware, Automatic Operators, Electrical and any other subcontractors the General Contractor feels need to be present for the discussion
 - d. Owner's Representatives responsible for the installation and coordination of the door hardware, including the following as applicable to the project: Low voltage, Security, Keying, etc
 2. Agenda: Review door function and design intent of specialized doors and parties responsible for each component necessary.
 3. Recording: The Contractor shall record discussions of conference and decisions reached, and furnish copy of record to each attendee.
- D. Where elsewhere required in individual Specification Sections, schedule a pre-installation meeting at the job-site prior to starting the work of the Section.
1. Require attendance of entities directly affecting, or affected by, the work of the Section.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01-3200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes administrative and procedural requirements for documenting the progress of construction during performance of the work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Submittals Schedule
 - 3. Digital photographs of job site conditions.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Contractor's Construction Schedule: Submit initial schedule, large enough to show entire schedule for entire construction period.
 - 2. Contractor's Submittal Schedule: Submit intended submittal schedule for entire project.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals
 - 1. Construction Photographs: Submit digital electronic files as a Project Record Document. Identify electronic media with dates photographs were taken.

1.3 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in scheduling and reporting.
- B. Prescheduling Conference: Conduct conference at project site to review methods and procedures related to the Contractor's Construction Schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including phasing, work stages and area separations.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review time required for review of submittals and resubmittals.
 - 7. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 8. Review time required for completion and startup procedures.
 - 9. Review and finalize list of construction activities to be included in schedule.
 - 10. Review submittal requirements and procedures.
 - 11. Review procedures for updating schedule.

1.4 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

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- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 - 1. Coordinate Submittals Schedule with list of subcontractors, the Schedule of Values, and Contractor's Construction Schedule.
 - 2. Initial Submittal: Submit concurrently with preliminary construction schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the work and those required early because of long lead time for manufacture or fabrication.
 - a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning and Scheduling."
- B. Time Frame: Extend schedule from date established for commencement of the work to date of Final Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each separate area as a separate numbered activity for each principal element of the work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 - 4. Startup and Testing Time: Include not less than seven days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.

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6. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work Under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the work performed by Owner.
 4. Owner-Furnished Products: Include a separate activity for each product with delivery date. Delivery dates indicated stipulate the earliest possible delivery date.
 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Partial occupancy before Substantial Completion.
 - b. Use of premises restrictions.
 - c. Seasonal variations.
 - d. Environmental control.
 6. Work Stages: Indicate important stages of construction for each major portion of the work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
 7. Area Separations: Identify each major area of construction for each major portion of the work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis to demonstrate the effect of the proposed change on the overall project schedule.
- G. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

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2.3 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for commencement of the work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the work and a cash requirement prediction based on indicated activities.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE- CRITICAL PATH METHOD (CPM)

- A. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.
 - 1. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 2. Use "one workday" as the unit of time.
- B. CPM Schedule Preparation: Prepare a list of all activities required to complete the work.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Purchase of materials.
 - c. Delivery.
 - d. Fabrication.
 - e. Installation.
 - f. Principal events of activity
 - g. Immediate preceding and succeeding activities.
 - h. Early and late start dates
 - i. Early and late finish date
 - j. Activity duration in workday
 - k. Total float or slack time
 - 2. Format: Mark the critical path.
- C. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.

2.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at project site.
 - 1. List of subcontractors at project site.
 - 2. List of separate contractors to project site.

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3. Approximately count of personnel at project site.
 4. High and low temperatures and general weather conditions.
 5. Accidents.
 6. Meetings and significant decisions.
 7. Unusual events (refer to special reports).
 8. Stoppages, delays, shortages, and losses.
 9. Meter readings and similar recordings.
 10. Emergency procedures.
 11. Orders and requests of authorities having jurisdiction.
 12. Change Orders received and implemented.
 13. Construction Change Directives received.
 14. Services connected and disconnected.
 15. Equipment or system tests and startups.
 16. Partial Completions and occupancies.
 17. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare a comprehensive list of materials delivered to and stored at project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- 2.6 SPECIAL REPORTS
- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at project site, whether or not related directly to the work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
- 2.7 PHOTOGRAPHIC MEDIA
- A. Digital Images: Provide images in PDF format.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor to provide planning, evaluation, and reporting using CPM scheduling.
1. Scheduling to be performed by skilled personnel with experience in CPM scheduling and reporting techniques.
 2. The individual with scheduling responsibility shall attend all meetings related to project progress, alleged delays, and time impact.

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- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the work progresses, indicate Actual Completion percentage for each activity.

- C. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in performance of construction activities.

3.2 CONSTRUCTION PHOTOGRAPHS

- A. Preconstruction Photographs: Before starting construction, take four color photographs of project site and surrounding properties from different vantage points, plus interior photographs as directed by Architect. Show existing conditions adjacent to property and existing interior conditions.

END OF SECTION

SECTION 01-3323
SHOP DRAWINGS, PRODUCT DATA, SAMPLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Procedures for processing:
 - 1. Shop Drawings
 - 2. Product Data
 - 3. Office Samples
 - 4. Mock-up Samples
 - 5. Certificate of Compliance
- B. See Section 01-3200 for Submittal Schedule procedures.
- C. See sections 01-7700, 01-7823 and 01-7833 for making closeout submittals.

1.2 GENERAL PROCEDURES

- A. The approval of submittals does not constitute a Change Order.
- B. All products shall be submitted with certification that the items meet ARRA Requirements.
- C. All items shall be submitted under Construction Manager's or Component Contractor's transmittal letter. The transmittal letter shall include the following information. If the following information is not included, the submittal will be returned un-reviewed for clarification.
 - 1. Project by title and Architect's project number.
 - 2. Contractor's contract number.
 - 3. Work and products by Specification Section, Article number and type (Product data, shop drawings, certification, etc.).
 - 4. All requirements for submittals specified in this section and individual sections of the Project Manual shall be complied with; partial submittals are not acceptable and will be returned by the Architect.
- D. Resubmittals: When Architect requires that a submittal be "resubmitted", comply with requirements of this section.
 - 1. Identify changes made since the previous submittal.
- E. Notify Architect in writing at time of submittal, of any deviations from the requirements of Contract Documents.
- F. Make all submittals far enough in advance of scheduled dates for installation to provide sufficient time for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
 - 1. Architect's Review Time: In scheduling, allow at least 10 working days for Architect's review. (This review time shall apply to Architect's initial review, and allow at least 10 working days to review any subsequent required revision or resubmittal.)

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2. Delays caused by the tardiness of the Contractor in preparing and forwarding of submittals (including failure to include time for possible revisions and resubmittals) will not be an acceptable basis for extension of the Contract completion date or for consideration of alternate products which do not meet the specified requirements of this Project Manual.
- G. Fabricating products which require submittals to be approved by Architect before Architect approves and returns the submittals to Contractor shall be at Contractor's risk.
- H. Starting work which requires submittals to be approved by Architect before Architect approves and returns the submittals to Contractor shall be at Contractor's risk.
- I. Where used in the Contract Documents, the words "or equal" shall be defined as "refer to substitution requirements" specified in Section 01-2513.

1.3 SHOP DRAWINGS

- A. Reproduction of any portion of the Architect's Construction Documents for use as submittals for shop drawings is not acceptable, such submittals will be returned unreviewed.
- B. Submit shop drawings in a clear and thorough manner.
 1. Title each drawing with Project name and Architect's project number.
 2. Identify each element of drawings by reference to sheet number and detail, schedule, or room number of Contract Documents.
- C. Identify the following:
 1. Requirements of the individual section of Project Manual.
 2. Field measurements.
 3. Field construction criteria.
 4. Relation to adjacent or critical features of the Work or products.
 5. Conformance of submittal with requirements of Contract Documents.
- D. Shop drawings shall be stamped and signed by Contractor before submitting to Architect. Certify compliance with requirements of Contract Documents. If submittals from the Contractor are marked anything except "approved" or "approved as noted," the submittal will be returned and not checked by the Architect.
 1. The contractor's stamp shall contain a line to be filled in to indicate the applicable specification section(s) of the particular submittal. Submittals received without this information included will be returned without action.
- E. Seismic Information: Include calculations showing the adequacy of the item, represented by the Shop Drawing, to resist the expected vertical and lateral forces as indicated.
- F. Fabricating products or beginning the work before shop drawings are approved by Architect and returned to Contractor shall be at Contractor's risk.
- G. Number of Copies Required: Submit the number which are required to be returned plus two copies which will be retained by the Architect.

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1.4 PRODUCT DATA

- A. Submit only pages which are pertinent.
 - 1. Mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number.
 - 2. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.
 - 3. Provide current safety data sheets for products and materials which are hazardous or potentially hazardous to handle and install in the project. A copy of the data sheets shall be on file in job office for use by employees on the job site.
- B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.
- C. Each set of manufacturer's product data shall be stamped and signed by Contractor before submitting to Architect to certify compliance with requirements of contract Documents.
- D. Number of Copies Required: Submit the number which are required to be returned plus two copies which will be retained by the Architect.

1.5 OFFICE SAMPLES

- A. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures, and patterns, for Architect's selection.
- B. Submit samples to illustrate functional characteristics of products, including parts and attachments.
- C. Approved samples which may be used in the Work are indicated in the Specification section.
- D. Label each sample with identification required for transmittal letter.
- E. Number Required: Submit the number which are required to be returned plus two copies which will be retained by the Architect.

1.6 MOCK-UP SAMPLES

- A. Where mock-up samples and similar samples are indicated in the individual specifications section, comply with requirements for "Office Samples", and process transmittal forms for mock-ups to provide a record of activity.

1.7 MOCK-UPS

- A. Exterior Building Mock-up: Before exterior finishes are started and Pre-installation Conference for Envelope and Roofing is held, provide an exterior mock-up for Owner and Architect review and approval of all exterior finish elements, materials and

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construction manner. Size mock-up to be approximately 6' x 10', of layout provided by Architect. Construct mock-up as detailed in the Contract Documents.

1. Mock-up to incorporate all finish materials and specific details, such as bond, control joints, reveals, etc.
2. Mock-up to incorporate a typical opening with all waterproofing provisions shown in contract documents, such as the subsill pan. Flashing, etc.
3. Owner will test the mock-up panel assembly for moisture infiltration with hose test prior to construction of the entire envelope. Any failures will be discussed and resolved prior to incorporation into the building.
4. Contractor to schedule building of mock-up to allow for review and testing and not impact schedule.
5. Mock-up to be maintained on-site until building exterior is complete. Keep mock-up clean until removed from site, coordinate time of removal with Architect.

1.8 CERTIFICATIONS OF COMPLIANCE

- A. Contractor shall submit "Certificates of Compliance" certifying that all materials used in the Work comply with all specified provisions thereof.
 1. Submit in the form of a letter or company standard forms.
 2. Include data or dates of testing and results of testing.

1.9 TEST REPORTS

- A. Test reports certified by an independent testing laboratory must be made available upon request by Architect.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01-4000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- B. See Section 01-4529 and the Drawings for specific test and inspection requirements.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.
 - 1. See Section 01-3323 for additional requirements.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Submittals: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design

professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 REPORTS AND DOCUMENTS

- A. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Ambient conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

- B. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. **Testing Agency Qualifications:** An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

1.6 QUALITY CONTROL

- A. **Owner Responsibilities:** Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. **Contractor Responsibilities:** Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
 - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. **Special Tests and Inspections:** Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
 - 1. See Section 01-4529 for code compliance testing requirements.
 - 2. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 - 4. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Testing agency will retest and reinspect corrected work.

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- D. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- E. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- F. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 - 5. Do not perform any duties of Contractor.
- G. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field-curing of test samples.
 - 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 6. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. **General:** On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

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2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
 - C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01-4517
UNCOVERING AND CORRECTION OF WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The requirements of Section 01-7329 Cutting and Patching form a part of this section and must be complied with.

1.2 UNCOVERING OF WORK

- A. If the Contract Documents, laws, ordinances, rules, regulations or orders of any Public Authority having jurisdiction require any portion of the Work to be inspected, the Contractor shall give the Architect timely notice of its readiness so that the Architect may observe such inspections.
- B. If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Architect, be uncovered for the Architect's observation and be replaced at the Contractor's expense without change in the Contract Time.
- C. If a portion of the Work has been covered which the Architect has not specifically requested to observe prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor.
 - 1. If such Work is in accordance with Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner.
 - 2. If such Work is not in accordance with Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

1.3 CORRECTION OF WORK

- A. The Contractor shall promptly correct the Work rejected by the Architect and/or the Public Authority, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed.
- B. The quality of materials and workmanship used in restoring this work shall be in full compliance with the requirements of the Contract Documents.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01-4529
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Laboratory services required to perform the specified testing shall be performed by an independent testing laboratory employed by the Owner.
- B. Contractors shall cooperate with the laboratory to facilitate the execution of its required services.
- C. Employment of the laboratory shall in no way relieve Contractors of obligations to perform the Work of the Contract.
- D. See Section 01-4000 for quality requirements.

1.2 QUALIFICATION OF LABORATORY

- A. Laboratory shall meet "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories.
- B. Laboratory shall be authorized to operate in the State in which the Project is located.

1.3 LABORATORY REPORTS

- A. After each inspection and test, Laboratory shall promptly submit the laboratory report to the Architect, Construction Manager, Owner, Structural Engineer, and Civil Engineer.
- B. Each report shall include:
 - 1. Date issued.
 - 2. Project Title and number.
 - 3. Testing laboratory name, address and telephone number.
 - 4. Name of laboratory inspector and job number.
 - 5. Date and time of sampling or inspection.
 - 6. Record of temperature and weather conditions.
 - 7. Date of test.
 - 8. Identification of specification section.
 - 9. Location of sample or test in the Project.
 - 10. Type of inspection or test and Identification of Testing Standard Specified and Used
 - 11. Results of tests and compliance with Contract Documents.
 - 12. Interpretation of test results.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 LABORATORY RESPONSIBILITIES

- A. Laboratory shall provide qualified personnel at site after due notice and cooperate with Architect and Contractor in performance of services.
- B. Laboratory shall perform specified inspection, sampling, and testing of products in accordance with specified standards.
- C. Laboratory shall ascertain compliance of materials and mixes with requirements of Contract Documents.
- D. Laboratory shall promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
- E. Laboratory shall perform additional inspections and tests required by Architect.
- F. Laboratory shall attend preconstruction conferences.

3.2 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor.
- D. Laboratory has no authority to stop Work.

3.3 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with laboratory personnel, and provide access to Work.
- B. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.
- C. Notify Architect and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.
 - 1. When tests or inspections cannot be performed after such notice, Contractor shall notify the laboratory.
 - 2. If Contractor does not notify laboratory before laboratory personnel are scheduled for this work, Contractor shall reimburse the Owner for laboratory personnel and travel expenses.

3.4 CODE COMPLIANCE TESTING * SECTION TO BE EDITED*****

- A. The following construction components are to be tested or otherwise approved per 2006 International Building Code, Chapter 17

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1. Structural Components: See Structural Drawings for details on the testing of the following components.
 - a. Structural Load-bearing Member Fabrication
 - b. Steel Construction
 - c. Concrete Construction
 - d. Soils
 - e. Special Foundations
2. Architectural Components: See Specification Sections and Architectural Drawings for additional details on the testing of the following components.
 - a. Sprayed Fire-resistant Materials
 - 1) Prepared surface complies with manufacturer's instructions.
 - 2) Thickness, density and bond strength of material.
 - 3) Verification of application per manufacturer's instructions.
3. Mechanical Components: See Mechanical Drawings for details on the testing of the following components.
 - a. Smoke Control Systems
4. Seismic Resistance: See Structural Drawings for details on the testing of the following components.
 - a. Structural Steel
 - b. Cold-formed Steel Framing
 - c. Pier Foundations
 - d. Architectural Components: Bearing and Non-bearing walls and veneers may need to be tested if in Category D,E or F, over 30' tall, veneer over 5psf, non-bearing walls over 15 psf
 - e. Mechanical Components

3.5 ADDITIONAL CODE COMPLIANCE TESTING

- A. Additional inspections and tests required by local codes or ordinances, or by a plan approval authority having jurisdiction over the project site, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless noted above or otherwise provided in the Contract Documents.

3.6 PAYMENT FOR TESTING

- A. Initial Services:
 1. When initial tests indicate non-compliance with the Contract Documents, the costs of initial tests associated with that non-compliance will be deducted by the Owner from the Contract Sum.
- B. Retesting:
 1. When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency and the costs thereof will be deducted by the Owner from the Contract Sum.
- C. Contractor's Convenience Testing:
 1. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

END OF SECTION

SECTION 01-5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Temporary facilities and controls including:
 - 1. Temporary utilities
 - 2. Construction aids
 - 3. Security and protection facilities.
 - 4. Access roads and parking
 - 5. Project identification and signs
 - 6. Field office and storage trailers

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Affidavit: Contractor shall submit affidavit verifying that polyethylene and similar covering materials comply with requirements.

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with Federal, state and local codes/regulations.
- B. Standards: Comply with applicable NFPA, ANSI, and NECA requirements.

1.4 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow to use temporary services and facilities without cost, including, but not limited to Owner, Architect, testing agencies, and authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Site Enclosure Fence: Provide commercial grade minimum 2", 0.148" thick, galvanized steel chain link fabric fencing equipped with vehicular (and pedestrian) gates and locks.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E84.
- C. Materials for temporary facilities and utilities may be new or used, but must be adequate in capacity for the required use. Materials used must not create unsafe conditions, and must not violate the requirements of applicable codes and standards.

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2.2 FIELD OFFICE AND STORAGE TRAILERS

- A. Provide a prefabricated, mobile unit or job built constructed weathertight field office with:
 - 1. Lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with furniture.
 - 2. Job telephone and fax machine.
 - 3. Computer, Internet service and email capability.
 - 4. Space for Project meetings, with table and chairs to accommodate a minimum of 12 persons.
 - 5. Work table large enough to accommodate working drawings.
 - 6. Hand carried, portable, UL rated fire extinguishers. Comply with NFFA 10 and NFFA 241 for classification, extinguishing agent and size required by location and class of fire exposure.
 - 7. Files, drawings, racks, and shelves to maintain order and neatness.
- B. Provide janitor service for the office.
- C. Provide lighted, weathertight storage trailer, for tools, materials and equipment with adequate space for organized storage and access. Provide heat and ventilation for products requiring controlled conditions.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations".
- B. Heating Units: Provide as required by CFR 29, 1926 OSHA Construction Industry Regulations, Section 1926.154, Temporary Heating Devices.

PART 3 - EXECUTION

3.1 GENERAL

- A. Location: Locate temporary facilities to preclude interference with work and as directed.
- B. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- C. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or not later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary

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facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in 01-7400.

3.2 TEMPORARY ELECTRICITY AND LIGHTING

- A. Temporary Electric Service: Arrange with utility company, provide service required for power and lighting, and pay all costs for service and for power used.
- B. Provide adequate artificial lighting for all areas of work when natural light is not adequate for work, and for areas accessible to the public.
- C. Lamps and Light Fixtures: Provide general service type incandescent lamps of wattage required for adequate illumination. Where exposed to breakage by construction operations, protect lamps with guard cages or tempered glass enclosures. Provide exterior type fixtures where exposed to weather or moisture.
- D. Electrical Power Cords: Use only grounded extension cords: "hard-service" type where exposed to abrasion and traffic. Use single lengths or tape intermediate connections with waterproof electrical tape, or use waterproof connectors.

3.3 TEMPORARY HEAT AND VENTILATION

- A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate process of the work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity.
- B. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gasses.
- C. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

3.4 TEMPORARY TELEPHONE/ INTERNET SERVICE/ DIGITAL CAMERA

- A. Arrange with local telephone service company, provide direct line telephone service at the construction site for the use of personnel and employees. Service required:
 1. One direct line instrument in Field Office.
 - a. At each telephone post and answering machine list of important telephone numbers

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- 1) Police and fire departments
 - 2) Ambulance service
 - 3) Contractor's home office
 - 4) Architect's office
 - 5) Engineer's office
 - 6) Owner's office
 - 7) Principal subcontractors' field and home offices
2. Other instruments at the option of the Contractor, or as required by regulations.
 3. Computer, internet service, email capability and digital camera.

- B. Pay all costs for installation, maintenance and removal, and service charges for local calls. Toll charges shall be paid by the party who places the call.

3.5 TEMPORARY WATER

- A. Arrange with utility service company, provide water for construction purposes; pay all costs for installation, maintenance and removal, and service charges for water used.
- B. Install branch piping with taps located so that water is available throughout the construction by the use of hoses. Protect piping and fittings against freezing.

3.6 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities in compliance with laws and regulations.
- B. Service, clean and maintain facilities and enclosures.

3.7 DRINKING WATER FACILITIES

- A. Provide containerized tap-dispenser bottled-water type drinking water units, including an adequate supply of paper cups. Use of Owner's drinking fountains is prohibited.

3.8 CONSTRUCTION AIDS

- A. Furnish, install and maintain required construction aids, remove on completion of Work.
- B. Comply with Federal, State and local codes and regulations.
- C. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.
- D. Provide construction aids and equipment required by personnel and to facilitate the execution of the Work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment.
- E. Provide and operate drainage and pumping equipment. Maintain excavations and site free of standing water.
- F. Maintain all facilities and equipment in a first class condition.

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3.9 TEMPORARY ROADS AND PAVED AREAS

- A. Contractor shall construct temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. If practical, locate temporary roads and paved areas in same location as permanent roads and paved areas.
- B. Access to site for delivery of construction materials and equipment shall be made only from locations as established by the Owner, Architect and Contractor at the pre-construction conference.

3.10 PROJECT IDENTIFICATION AND SIGNS

- A. General: Refer to the page following this section for requirements in regards to a Construction Sign. Specifics on wording shall be established prior to construction.

3.11 TEMPORARY CONSTRUCTION

- A. Provide temporary weather-tight enclosure of exterior walls for successive areas of the building as work progresses, as necessary to provide acceptable working conditions, provide weather protection for interior materials, allow for effective temporary heating, and to prevent entry of unauthorized persons.
 - 1. Provide temporary exterior doors with self-closing hardware and padlocks.
 - 2. Other enclosures shall be removable as necessary for work and for handling of materials.
- B. Temporary roof, partition and ceiling enclosure framing and sheet materials shall comply with structural and fire rating requirements of applicable codes and standards.
 - 1. Polyethylene type coverings to be used for interior and exterior protection of stored materials or products, temporary dust walls, or as weather protection at openings in exterior walls or ceilings to meet requirements in this section.
 - 2. Close joints between sheet materials, and seal edges and intersections with existing surfaces with fire retardant tape to prevent penetration of dust or moisture.
 - 3. Construct gypsum board enclosures in occupied areas, if required, to provide STC rating of 50, determined in accordance with ASTM E-90.
 - 4. Paint surfaces of gypsum board enclosures exposed to public view and in Owner occupied areas.
 - 5. See section 01-3533 for additional requirements

3.12 SECURITY AND PROTECTION FACILITIES

- A. General: Provide as required to prevent public entry to construction areas and adjacent properties from damage from construction operations.
- B. Site Enclosure Fence: Before construction begins, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering the site except by entrance gates.
- C. Barricades, Warning Signs and Lights: Comply with standard and code requirements and authorities having jurisdiction. Provide barricades and temporary lighting at streets and open ditches where construction work may present hazards to vehicles and personnel. Where appropriate provide flashing red or amber lights.

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- D. Tree and Plant Protection: Provide barriers around trees and plants designated to remain and those adjacent to the site. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.
 - 1. Replace, or suitably repair, trees and plants designated to remain which are damaged or destroyed due to construction operations.

3.13 TEMPORARY FIRE PROTECTION

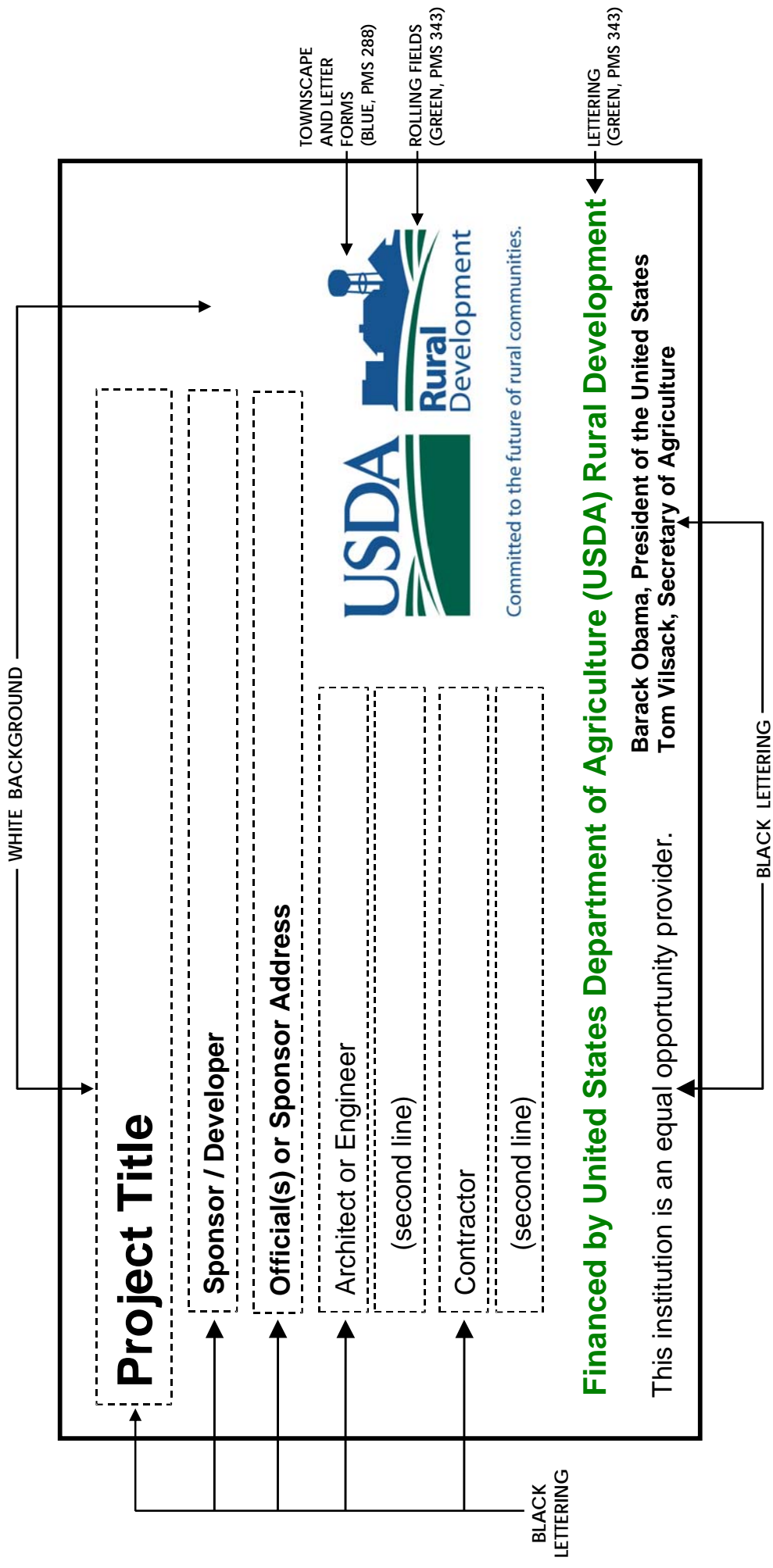
- A. Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses.
- B. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each exit.
- C. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, exits and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
- D. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- E. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

3.14 REMOVAL

- A. Remove temporary materials, equipment, services and construction prior to Substantial Completion.
- B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of two feet and grade as indicated or directed by the Architect.

END OF SECTION

TEMPORARY CONSTRUCTION SIGN FOR RURAL DEVELOPMENT PROJECTS



SIGN DIMENSIONS: 1200 mm x 2400 mm x 19 mm (approx. 4' x 8' x 3/4")
PLYWOOD PANEL (APA RATED A-B GRADE-EXTERIOR)

SECTION 01-6500
PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 PACKAGING AND TRANSPORTATION

- A. Require supplier to package products in boxes or crates for protection during shipment. Protect sensitive products against exposure to elements and moisture.
- B. Protect sensitive equipment and finishes against impact, abrasion and other damage.

1.2 DELIVERY

- A. Arrange deliveries of products, including products furnished by the Owner, in accordance with construction schedules and in ample time to facilitate inspection prior to installation.
- B. Coordinate to avoid conflict with work and conditions at the site. Specifically coordinate to determine:
 - 1. Work of the Owner.
 - 2. Products furnished by the Owner.
 - 3. Work of other contractors.
 - 4. Availability of equipment and personnel for handling products.
 - 5. Owner's use of premises.
- C. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
- D. Clearly mark partial deliveries of component parts of equipment to permit easy accumulation of parts and to facilitate assembly.
- E. Immediately on delivery, inspect shipments to assure:
 - 1. Compliance with requirements of Contract Documents and approved submittals.
 - 2. Quantities are correct.
 - 3. Containers and packages are intact and that labels are legible.
 - 4. Products are properly protected and undamaged.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

PRODUCT STORAGE AND HANDLING REQUIREMENTS 01-6600-1
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SECTION 01-6600
PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL STORAGE

- A. Store and handle products immediately on delivery in accordance with the manufacturer's printed instructions, with seals and labels intact and legible, and protect until installed in the work.
- B. Arrange storage in a manner to provide easy access for inspection.

1.2 ENCLOSED STORAGE

- A. Store products subject to damage by the elements in substantial weathertight enclosures.
- B. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
- C. Store unpacked products on shelves, in bins or in neat piles, accessible for inspection.

1.3 EXTERIOR STORAGE

- A. Provide substantial platforms, blocking or skids to support fabricated products above the ground to prevent soiling or staining.
- B. Cover products which are subject to discoloration or deterioration from exposure to the elements with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
- C. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- D. Provide surface drainage to prevent flow or ponding of rainwater.
- E. Prevent mixing of refuse or chemically injurious materials or liquids.

1.4 MAINTENANCE OF STORAGE

- A. Maintain a periodic system of inspections of stored products on a scheduled basis to assure that:
 - 1. Condition of storage facilities is adequate to provide required conditions.
 - 2. Required environmental conditions are maintained on a continuing basis.
 - 3. Surfaces of products exposed to elements are not adversely affected.
 - 4. Note: Any weathering of products, coatings and finishes is NOT acceptable under requirements of the Contract Documents.
- B. Have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on the exterior of the package, for mechanical and electrical equipment which requires servicing during long term storage.

PRODUCT STORAGE AND HANDLING REQUIREMENTS 01-6600-2

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1. Comply with the manufacturer's instructions on a scheduled basis.
2. Connect space heaters which are part of the electrical equipment and operate continuously until equipment is placed in service.

1.5 PROTECTION AFTER INSTALLATION

- A. Provide substantial coverings to protect installed products from damage from subsequent operations. Remove when no longer needed, prior to completion of work.
- B. Control traffic to prevent damage to equipment and surfaces.
- C. Provide coverings to protect finished surfaces from damage.
- D. Cover projections, wall corners, jambs, sills and soffits of openings, in areas used for traffic and passage of products in subsequent work.
- E. Protect finished floors and stairs from dirt and damage.
- F. In other areas subject to foot traffic, secure heavy paper, sheet goods on the materials in place.
- G. For movement of heavy products, lay planking or similar materials in place
- H. Waterproofed and roofing surfaces:
 1. Prohibit use of surfaces for traffic of any kind, and for storage of any products.
 2. When some activity must take place in order to carry out the Contract, obtain recommendations of the installer for protection of surface.
 3. Install recommended protection and remove on completion of that activity.
 4. Restrict the use of adjacent unprotected areas.
- I. Prohibit traffic of any kind across planted lawn and landscaped areas.

1.6 PRODUCT HANDLING

- A. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.
- B. Provide additional protection during handling as necessary to prevent scraping, marring, or otherwise damaging products or surrounding spaces.
- C. Handle products by using methods that will prevent bending or over stressing.
- D. Lift heavy components only at designated lifting points.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01-7329
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section modifies the General Conditions to include incidental requirements and limitations for cutting, fitting and patching that may be required within the new construction to complete the Work, or make its several parts fit together. Incidental cutting and patching is performed for coordination of the Work, to uncover for access or inspection, to obtain samples for testing, and to permit alterations to be performed or for similar purposes.

1.2 ADVANCED WRITTEN REQUESTS

- A. Submit written request in advance of cutting or alteration work which affects the following:
 - 1. Structural integrity of any element of the Project.
 - 2. Integrity of weather-exposed or moisture-resistant element.
 - 3. Efficiency, maintenance or safety of any operational element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Work of Owner or separate contractor.
- B. Include the following in each written request:
 - 1. Identification of Project.
 - 2. Location and description of affected work.
 - 3. Necessity for cutting or alterations.
 - 4. Description of proposed work, and materials and products to be used.
 - 5. Alternative to cutting and patching.
 - 6. Effect on work of Owner or separate contractor.
 - 7. Written permission of the affected separate contractor.
 - 8. Date and time the work will be executed.

1.3 QUALITY ASSURANCE

- A. General: Employ skilled workmen or firms qualified to perform cutting and patching specified in this section. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- B. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
- C. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut and patch construction exposed on exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic or visual qualities. Do not cut and patch construction in a manner that would

result in visual evidence of cutting and patching. Remove and replace construction which was cut and patched in a visually unsatisfactory manner.

- E. Warranty: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void required warranties.

1.4 DESCRIPTION

- A. Install Work in such a manner and sequence as to preclude or minimize cutting and patching of new Work.
- B. Execute cutting, fitting or patching of Work, required to:
 - 1. Make several parts fit properly.
 - 2. Uncover Work to provide for installation of ill timed Work.
 - 3. Remove and replace defective Work.
 - 4. Remove and replace non-conforming Work.
 - 5. Remove samples of installed Work for testing.
 - 6. Install specified Work in existing construction.
 - 7. Provide rerouting penetrations of non-structural surfaces for installation of piping and electrical conduit.
 - 8. Patch and repair fireproofing damaged after installation of other Work or demolition activities.
 - 9. Remove and finish construction at connections to other structures.
- C. Do not cut building framing members or modify the foundation without written approval or consent of Architect.
- D. Be responsible for damage resulting from violation of these provisions.
- E. Use only firms or individual trades qualified to perform Work required under this Section.

1.5 JOB CONDITIONS

- A. Before start of Work, obtain and pay for all permits required by all authorities having jurisdiction and notify all interested utilities companies.
- B. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- C. Items to be salvaged and delivered to Owner shall be carefully removed and properly stored in an area easily accessible for removal by Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Types: New materials and products of types and quality identical to existing materials.
- B. For exposed surfaces, use materials that visually match existing adjacent surfaces.
- C. Use materials whose installed performance will equal or surpass that of existing materials.

- D. Comply with specifications for type of Work to be performed.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Perform preliminary investigations as required to ascertain extent of Work.
 - 1. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.
- B. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
- C. Before proceeding, meet at Project Site with parties involved in cutting and patching, including mechanical and electrical trades.
 - 1. Review areas of potential interference and conflict.
 - 2. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

- A. Provide adequate shoring, bracing and support as required to maintain structural integrity of Project.
- B. Provide protection from elements for other portions of Project which may be affected.
- C. Erect and maintain dustproof partitions as required to prevent spreading of dust, fumes and smoke to other parts of the building.

3.3 CUTTING AND REMOVAL - GENERAL

- A. Execute fitting and adjustment to provide finished installation to comply with specified tolerances and finishes.
- B. Execute cutting by methods which will prevent damage to existing or other Work and will provide proper surfaces to receive installation of new Work.
- C. Neatly cut and remove materials, and prepare all openings to receive new Work.
- D. Concrete or masonry shall be removed in small sections.
- E. Provide shoring, bracing, and other supports to prevent movement, settlement, or collapse of remaining or adjacent wall areas, structure, or facilities.
- F. Arrange shoring, bracing, and supports to prevent overloading of structure.
- G. Take all precautions necessary to prevent damage to existing remaining work or to adjacent facilities.
- H. Use methods which will prevent interference with use of remaining and adjacent facilities by Owner.
- I. Provide for cutting, fitting, repairing, patching and finishing of Work disturbed by installation of new Work.

3.4 MATCHING AND PATCHING

- A. At penetrations of fire-rated walls, ceilings, or floor construction, completely seal voids with fire-rated material, full thickness of the construction element.
- B. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- C. Use methods and materials similar in appearance, and equal in quality to areas or surfaces being repaired.
- D. Restore Work which has been cut or removed; install new products to provide completed Work in accord with requirements of Contract Documents.
- E. Patch Work must in every way possible match adjacent surfaces.
- F. Re-finish entire surfaces as necessary to provide an even finish to match adjacent finishes.
 - 1. Continuous surfaces; to nearest intersections.
 - 2. Assembly - entire refinishing.

END OF SECTION

SECTION 01-7400
CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SITE MAINTENANCE

- A. Maintain premises and public properties free from accumulations of waste, debris, and rubbish caused by operations.
- B. Keep streets clean from mud, dirt, debris, and other materials removed from the job site.
- C. At completion of work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials. Clean all sight-exposed surfaces.
- D. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 - 1. Do not burn or bury rubbish and waste materials on project site.
 - 2. Do not dispose of volatile waste such as mineral spirits, oil, and paint thinner in storm drains or sanitary sewers.
- E. Hazard Control:
 - 1. Store volatile wastes in covered metal containers, and remove from premises daily.
 - 2. Prevent accumulation of waste which might cause hazardous conditions.
 - 3. Provide adequate ventilation during use of volatile and noxious substances.

1.2 PROGRESS CLEANING

- A. Keep building, grounds, and public properties free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to prevent dust.
- C. During progress of Work, clean site and public properties and dispose of waste materials, debris and rubbish.
- D. Provide on-site containers for collection of waste materials, debris, and rubbish.
- E. Vacuum interior building areas, where work is performed prior to painting and other finish work.
- F. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, new painted surfaces.

1.3 FINAL CLEANING

- A. Employ experienced workmen or professional cleaners for final cleaning.
- B. In addition to removal of debris and cleaning specified in other sections, clean interior and exterior exposed-to-view surfaces.

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- C. Remove temporary protection and labels not required to remain.
- D. Clean finishes free of dust, stains, films and other foreign substances.
- E. Clean transparent and glossy materials to a polished condition; remove foreign substances. Polish reflective surfaces to a clear shine.
- F. Vacuum clean carpeted and similar soft surfaces.
- G. Clean resilient and floor finishes as specified.
- H. Clean surfaces of equipment; remove excess lubrication.
- I. Clean plumbing fixtures to a sanitary condition.
- J. Clean permanent filters of ventilating equipment and replace disposable filters when units have been operated during construction; in addition, clean ducts, blowers, and coils when units have been operated without filters during construction.
- K. Clean light fixtures and lamps.
- L. Remove debris, rubbish, dirt, etc. from open concealed spaces, chases and above ceilings.
- M. Repair, patch, and touch-up marred surfaces to specified finish and to match adjacent surfaces.
- N. Remove waste, foreign matter, and debris from roofs and drainage systems.
- O. Remove waste, debris, and surplus materials from site. Clean grounds; remove stains, spills, and foreign substances from paved areas and sweep clean. Rake clean other exterior surfaces.
- P. Maintain cleaning until Final Completion.
- Q. Prior to Final Completion, or Owner occupancy, Contractor shall conduct an inspection of sight exposed interior and exterior surfaces, and all work areas, to verify that the entire work is clean.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01-7700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUBSTANTIAL COMPLETION

- A. When Work is considered to be substantially complete, submit the following to Architect:
 - 1. Written notice that the Work, or designated portion, is substantially complete.
 - 2. List of items to be completed or corrected (contractor's punch list).
- B. Within a reasonable time, Architect will inspect to determine status of completion, and compile a punch list of items to be completed and corrected. If Architect determines that Work is not substantially complete, he will immediately notify Contractor in writing. Architect will generally point out his reasons, but he will not be obligated to give an exhaustive list of discrepancies.
- C. Contractor's Duties: Remedy deficiencies and send Architect another written Notice of Substantial Completion.
- D. Architect's Actions:
 - 1. Reinspect the Work.
 - 2. When Architect considers Work substantially complete, he will issue the Certificate of Substantial Completion.

1.2 AGENCY INSPECTIONS

- A. When Work is considered to be substantially complete, the Contractor shall schedule inspections by all applicable authorities having jurisdiction. The Contractor shall notify the Owner and Architect of the anticipated date of these inspections, and further advise of any action needed by Owner and Architect to facilitate these inspections.
- B. An inspection by the state and local authorities having jurisdiction will be required following Substantial Completion and prior to Owner Occupancy. The Contractor shall notify the Architect approximately 30 days prior to the desired State Health Department inspection date so that the Architect may schedule this inspection. The Contractor shall have the documentation complete and in good order to review during the inspection, including, but not limited to:
 - 1. Certificate of Compliance or Occupancy issued by the local building official.
 - 2. Certification of Compliance issued by the state fire marshal.
 - 3. Medical Gas Certification.
 - 4. Sprinkler Certification.
 - 5. Fire Alarm Installation Certification. (Applicable State form, completed by Fire Alarm Installer.)
 - 6. Documentation of flame spread ratings of vinyl wall coverings.
 - 7. Elevator Certification.
 - 8. Mechanical, Electrical Systems Certification.
 - 9. Nurse Call/Code Blue Certification.
 - 10. Final Test & Balance Report.
 - 11. Emergency Generator Start-up Sheets & most recent Test Run.
 - 12. Certification that hot water temperatures are properly adjusted.

13. Certification that kitchen equipment is installed and fully operational.

1.3 OWNER OCCUPANCY

- A. Owner's Action: Occupy the Project, or designated portion of the Project, in accordance with provisions of the Certificate of Substantial Completion.
- B. Contractor's Duties:
 - 1. Obtain Certificate of Occupancy if required by local building codes authority.
 - 2. Obtain consent of insurance company or companies to keep insurance in force during partial occupancy by Owner.
 - 3. Make corrections listed on punch list attached to Certificate of Substantial Completion.
 - 4. Perform final clean-up.

1.4 FINAL COMPLETION

- A. When Work is considered to be complete, Contractor shall submit certification indicating the following:
 - 1. Contract Documents have been reviewed and Work has been inspected for compliance with those Documents.
 - 2. Work has been completed in accordance with Contract Documents.
 - 3. All punch list items have been corrected.
 - 4. Equipment and systems have been tested in presence of Owner's Representative and are operational.
 - 5. Work is complete and ready for final inspection.
- B. Architect's Actions During Final Inspection:
 - 1. Inspect to verify the status of completion with reasonable promptness.
 - 2. If he considers Work incomplete or defective, he will promptly notify Contractor in writing, listing deficiencies.
- C. Contractor's Duties: Take immediate action to correct deficiencies, and send certification to Architect that Work is complete.
- D. When Architect determines that Work is acceptable, he will request Contractor to make closeout submittals.

1.5 REINSPECTION FEES

- A. Should status of completion of work require reinspection by Architect due to failure of work to comply with Contractor's claims on initial inspection, Owner will deduct the amount of Architect compensation for reinspection services from final payment to Contractor.

1.6 CONTRACTOR'S CLOSEOUT SUBMITTALS REQUIRED

- A. Documents required by State Licensure inspectors and other authorities having jurisdiction.
- B. Certification that new work in building is asbestos free as required in Section 01-1100.
- C. Project Record Documents: Comply with Section 01-7839.

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- D. Operation and Maintenance Data: Comply with Section 01-7823.
- E. Product Warranties and Bonds: Comply with Section 01-7833.
- F. Keys and Keying Schedule: Comply with Section 08-7100.
- G. Evidence of Payment and Release of Liens: Comply with requirements and Conditions of the Contract.
- H. Consent of Surety to Final Payment.
- I. Certificates of Insurance for Products and Completed Operations: Comply with Supplementary Conditions.
- J. Test Results: Complete, dated test results of various systems signed by person authorized to sign for a qualified testing agency which conducted tests.
- K. Provide products, spare parts and maintenance materials in quantities specified in each section, in addition to that used for construction of the work.
 - 1. Coordinate with Owner; deliver to Project Site and obtain receipt to include with final payment.

1.7 STATEMENT OF ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement to Architect indicating all adjustments to the Contract Sum. Include the following:
 - 1. Original Contract Sum.
 - 2. Previous change orders.
 - 3. Changes under allowances.
 - 4. Changes under unit prices.
 - 5. Deductions for uncorrected work.
 - 6. Penalties and bonuses.
 - 7. Deductions for liquidated damages.
 - 8. Deductions for reinspection fees.
 - 9. Other adjustments to Contract Sum.
 - 10. Total Contract Sum, as adjusted.
 - 11. Previous payments.
 - 12. Sum remaining due.
- B. If required, a final Change Order will be prepared reflecting approved adjustments to Contract Sum which were not previously made on Change Orders.

1.8 FINAL APPLICATION FOR PAYMENT

- A. Submit final Application for Payment in accordance with procedures and requirements of the Conditions of the Contract.

1.9 FINAL PAYMENT

- A. Owner will make final payment.
- B. If the final payment is materially delayed through no fault of the Contractor, the Owner may issue a semi-final payment.

1.10 POST-CONSTRUCTION INSPECTION

- A. Prior to expiration of one year from the Date of Substantial Completion, the Architect will make a visual inspection of the Project to determine whether correction of Work is required, in accordance with the Conditions of the Contract.
- B. The Architect will promptly notify the Contractors, in writing, of any observed deficiencies. Contractors shall then correct deficiencies promptly.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01-7823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.
- B. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
- C. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

1.2 QUALITY ASSURANCE

- A. Have data prepared by personnel:
 - 1. Trained and experienced in maintenance and operation of the described products.
 - 2. Completely familiar with requirements of this Section.
 - 3. Skilled as a technical writer to the extent required to communicate essential data.
 - 4. Skilled as a draftsman competent to prepare required drawings.

1.3 SUBMITTALS

- A. Submit a copy of preliminary draft of proposed format and outline of contents of the operating and maintenance instructions manuals prior to Substantial Completion.
- B. Submit one copy of completed manuals in final form prior to final inspection or acceptance.
- C. Submit two (2) copies of approved manuals in final form after final inspection or acceptance.

PART 2 - PRODUCTS

2.1 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

- A. Prepare a neatly typewritten table of contents for each volume, arranged in a systematic order, to include:
 - 1. Contractor, name of responsible principal, address, and telephone number.
 - 2. A list of each product required to be included, indexed to the content of the volume.
 - 3. List, with each product, the name, address, and telephone number of:
 - a. Subcontractor or installer.
 - b. Maintenance contractor, as appropriate.
 - c. Identify the area of responsibility of each.
 - d. Local source of supply for parts and replacement.
 - 4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
- B. Product Data:

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1. Include only those sheets which are pertinent to the specific product.
2. Annotate each sheet to:
 - a. Clearly identify the specific product or part installed.
 - b. Clearly identify the data applicable to the installation.
 - c. Delete references to inapplicable information.
- C. Drawings:
 1. Supplement product data with drawings as necessary to clearly illustrate:
 - a. Relations of component parts of equipment and systems.
 - b. Control and flow diagrams.
 2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 3. Do not use Project Record Documents as maintenance drawings.
- D. Written text, as required to supplement product data for the particular installation:
 1. Organize in a consistent format under separate headings for different procedures.
 2. Provide a logical sequence of instructions for each procedure.
- E. Provide information sheet for Owner's personnel noting:
 1. Proper procedures in the event of failure.
 2. Instances which might affect the validity of warranties or bonds.

2.2 MATERIAL INFORMATION

- A. Content for architectural products:
 1. Manufacturer's data, giving full information on products.
 2. Information required for reordering specially manufactured products.
 3. Instructions for care and maintenance.
 4. Manufacturer's recommendation for types of cleaning agents and methods.
 5. Cautions against cleaning agents and methods which are detrimental to the product.
 6. Recommended schedule for cleaning and maintenance.
- B. Content for moisture protection and weather exposed products:
 1. Manufacturer's data, giving full information on products.
 2. Applicable standards.
 3. Chemical composition.
 4. Details of installation.
- C. Instructions for inspection, maintenance and repair.
- D. Additional requirements for maintenance data: The respective section of Specifications.
- E. Provide complete information for products of sections of the Project Manual.

2.3 EQUIPMENT AND SYSTEMS INFORMATION

- A. Content for each unit of equipment and system, as appropriate:
 1. Description of unit and component parts.
 2. Function, normal operating characteristics, and limiting conditions.
 3. Performance curves, engineering data, and tests.
 4. Complete nomenclature and commercial number of all replaceable parts.

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- B. Operating Procedures:
 - 1. Start-up, break-in, routine and normal operating instructions.
 - 2. Regulation, control, stopping, shutdown, and emergency instructions.
 - 3. Summer and winter operating instructions.
 - 4. Special operating instructions.

- C. Maintenance Procedures:
 - 1. Routine operations.
 - 2. Guide to "troubleshooting."
 - 3. Disassembly, repair, and reassembly.
 - 4. Alignment, adjusting, and checking.

- D. Servicing and lubrication schedule.
 - 1. List of lubricants required.

- E. Manufacturer's printed operating and maintenance instructions.

- F. Description of sequence of operation by control manufacturer.

- G. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams, required for maintenance.
 - 1. Predicted life of parts subject to wear.
 - 2. Items recommended to be stocked as spare parts.

- H. As-installed control diagrams by controls manufacturer.

- I. Each contractor's coordination drawings.
 - 1. As-installed color coded piping diagrams.

- J. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

- K. Other data as required under pertinent sections of Specifications.

- L. Content for each electrical and electronic system, as appropriate:
 - 1. Description of system and component parts.
 - 2. Function, normal operating characteristics and limiting conditions.
 - 3. Performance curves, engineering data, and tests.
 - 4. Complete nomenclature and commercial number of replaceable parts.
 - 5. Circuit directories of panelboards.
 - 6. Electrical service.
 - 7. Controls.
 - 8. Communications.
 - 9. As-installed color-coded wiring diagrams.
 - 10. Operating schedules:
 - a. Routine and normal operating instructions.
 - b. Sequences required.
 - c. Special operating instructions.
 - 11. Maintenance procedures:
 - a. Routine operations.
 - b. Guide to "troubleshooting."
 - c. Disassembly, repair, and reassembly.
 - d. Adjustment and checking.

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12. Manufacturer's printed operating and maintenance instructions.
 13. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
 14. Other data as required under pertinent section of Specifications.
- M. Prepare and include additional data when the need for such data becomes apparent during the instruction of Owner's personnel.
- N. Additional requirements for operating and maintenance data: The respective sections of Specifications.
- O. Provide complete information for products of sections of the Project Manual.
- 2.4 INSTRUCTION OF OWNER'S PERSONNEL
- A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment, and systems.
- B. Record all instructions and provide on DVD with manuals.
- C. For each item, record the following information:
1. Time and date of instruction.
 2. Name(s) of personnel providing instruction.
 3. Name(s) of personnel receiving instruction.
 4. Items covered during instructions.
- D. Use operating and maintenance manual to constitute the basis of instruction.
1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Prepare data in the form of an instructional manual for use by Owner's personnel. Organize information by sections of the Project Manual.
- B. Format:
1. Paper: 8-1/2" x 11", white.
 2. Text: Manufacturer's printed data, or neatly typewritten.
- C. Drawings:
1. Provide reinforced punched binder tab; bind in with text.
 2. Fold larger drawings to the size of the text pages.
- D. Product Literature:
1. Provide fly-leaf for each separate product, or each piece of operating equipment.
 2. Provide typed description of product, and major component parts of equipment.
 3. Provide indexed tabs.
- E. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS", etc.

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- F. List:
 - 1. Title of Project.
 - 2. Identity of separate structure as applicable.
 - 3. Identity of general subject matter covered in manual.

- G. Binders:
 - 1. Commercial quality three-ring binders with durable and cleanable plastic covers.
 - 2. When multiple binders are used, correlate the data into related consistent groupings.

END OF SECTION

SECTION 01-7833
PRODUCT WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide warranties and bonds required for specific products in individual Specifications Sections. See Section 01-1100.

1.2 SUBMITTALS

- A. Submit a copy of preliminary draft of proposed format and outline of contents of the warranties and bonds manuals prior to Substantial Completion.
- B. Submit one copy of completed manuals in final form prior to final inspection or acceptance.
- C. Submit two (2) copies of approved manuals in final form after final inspection or acceptance.
- D. For items of work when acceptance is delayed beyond date of Substantial Completion, submit documents to Architect after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS

2.1 WARRANTIES AND BONDS MANUALS

- A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers and manufacturers, after completion of the applicable item of work.
 - 1. Except for items put into use with Owner's permission, leave date of beginning of time of warranty blank until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Bind in commercial quality 8-1/2 x 11 three-ring side binders, with plastic covers.
- B. Label cover of each binder with typed or printed title, "WARRANTIES AND BONDS," with title of Project; name, address, and telephone number of Contractor; and name of responsible principal.
- C. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified and the name of product or work item.

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- D. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing.
 - 1. Provide full information, using separate typed sheets as necessary.
 - 2. List subcontractor, supplier, and manufacturer, with name, address and telephone number of responsible principal.

END OF SECTION

SECTION 01-7839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Procedural requirements for maintaining documents and samples at the site as required in the General Conditions.
 - 1. Coordinate with Divisions 23 and 26 through 28 for Mechanical and Electrical requirements.

- B. The General Conditions require the Construction Manager and Component Contractor to maintain a record copy of the following for Architect's review:
 - 1. Drawings showing architectural and engineering systems and components.
 - 2. Specifications and Schedule (Project Manual).
 - 3. Addenda.
 - 4. Change Orders and other documents which modify original document.
 - 5. Approved shop drawings, product data and samples.
 - 6. Records of all changes made during construction.

- C. In addition to the above, Contractor shall maintain at the site a record copy of the following:
 - 1. Field test records.
 - 2. Manufacturer's certificates.
 - 3. Fixed equipment manuals.
 - 4. Inspection certificates.

1.2 SUBMITTALS

- A. At Contract Closeout Submit:
 - 1. Record Documents and samples, including Record Drawings.
 - 2. Surveyor's certificate for building location, first floor elevation, handicap ramps, to Architect.

- B. Submit Record Documents and Surveyor's Certificate under cover of a transmittal letter containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's and subcontractor's names and addresses.
 - 4. Title and number of each Record Document.
 - 5. Certification that each document submitted is complete and accurate.
 - 6. Signature of Contractor or his authorized representative.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Drawings which are required for Owner's records, shall be recorded by the both the Construction Manager and Component Contractor.

- B. Construction Manager and Component Contractor shall transfer all changes recorded on construction drawings on the Record Drawings.
 - 1. All information shall be recorded neatly and legible.
 - 2. Use separate colors for recording information about each major system.
 - 3. Establish a code to denote the color for each trade and indicate by a schedule placed on the front sheet of the Record Drawings.
- C. Construction Manager shall include with Record Document Submittal a certificate and drawing, from a surveyor licensed in the state in which the project is located, verification of the building location and first floor elevation.
- D. Construction Manager shall include with Record Document Submittal a certificate and drawing, from a surveyor licensed in the state in which the project is located, verification that handicap ramp slopes are not greater than slopes indicated on project documents, and that the widths and lengths of the ramps indicated are considered minimums per governing codes.

PART 3 - EXECUTION

3.1 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store Record Documents and samples in a file in the Field Office, apart from the documents used for construction.
 - 1. Provide files, racks and secure storage for Record Documents and samples.
- B. Label and file Record Documents in sequence with section number listings in Table of Contents of this Project Manual.
 - 1. Label each document "PROJECT RECORD" in the lower right hand corner in neat, large printed letters.
- C. Maintain Record Documents in clean, dry, legible condition.
 - 1. Do not use Record Documents for construction purposes.
- D. Keep Record Documents and samples available for inspection by Architect and Engineer.

3.2 RECORDING

- A. Record information concurrently with construction progress.
 - 1. Do not conceal work until required information has been recorded.
- B. Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including the following:
 - 1. Depth of footings in relation to finish first floor level.
 - 2. Measure horizontal and vertical locations of underground utilities, valves, etc. referenced to building exterior lines. Show direction of flow of pipe and depth of piping underground.
 - 3. Field changes of dimensions and details.
 - 4. Changes made by Contract Modifications.
 - 5. Details not on original Contract Drawings.
 - 6. Fixed equipment.

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- C. Project Manual: Legibly mark to record actual construction, including the following:
 - 1. On appropriate pages, record changes made by Addenda, Change Orders and other modifications.
 - 2. On appropriate pages, enter trade name, manufacturer, catalog number, and name of supplier of each product and item actually installed, if different from that specified.
 - 3. Other items installed but not originally specified.

END OF SECTION

SPARE PARTS AND MAINTENANCE MATERIALS 01-7841-1
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SECTION 01-7841
SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 SPARE PARTS AND TOOLS

- A. Package in clearly identified boxes.
 - 1. Indicate manufacturer's name, part name and stock number.
 - 2. Indicate piece of equipment part or tool is for.
 - 3. Indicate name, address and phone number of closest supplier.

1.2 MAINTENANCE MATERIALS

- A. Package in clearly identified boxes.
 - 1. Indicate trade name and stock number.
 - 2. Indicate which item material is to be used with.
 - 3. Indicate name, address and phone number of closest supplier.

1.3 EXTRA MATERIALS

- A. Package in clearly identified containers, or install where indicated.
 - 1. Indicate trade name, stock number, size, color, etc.
 - 2. Indicate where product is to be used.
 - 3. Indicate name, address and phone number of closest supplier.
- B. See individual specification sections for quantity required.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 DELIVERY

- A. Deliver to Owner prior to substantial completion unless Owner requests earlier delivery.
- B. Deliver to location directed by Owner.
- C. Use transmittal form acceptable to Architect.
 - 1. Transmittal to indicate Owner's acceptance.

END OF SECTION

SECTION 04-2200
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Concrete unit masonry walls complete with mortar and accessories.
- B. Reinforced concrete unit masonry.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Certification: From concrete masonry unit manufacturer and distributor certifying the units delivered to job-site meet the requirements of this section.
 - 2. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
 - 3. Manufacturer's Product Data: Indicating full compliance with requirements of this section, for each of the following:
 - a. Horizontal joint reinforcement.
 - b. Premixed Mortar (data is required if used).
 - c. Grout materials.
 - d. Each type of masonry unit ties.

1.3 QUALITY ASSURANCE

- A. Concrete masonry units shall be obtained from one manufacturer.
- B. At least one skilled journeyman mason shall be present at all times during masonry work to personally supervise work of this section.

1.4 DELIVERY, HANDLING, STORAGE

- A. Masonry units shall be delivered to job-site in accordance with manufacturer's recommendations and Section 01-6500.
 - 1. Cracked, chipped and spalled masonry units shall be immediately removed from job-site.
- B. Store and protect masonry units in accordance with manufacturer's recommendation and Section 01-6600.
- C. Mortar materials shall be delivered to job-site in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- D. Store and protect mortar materials in accordance with manufacturer's recommendation and Section 01-6600.
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.
 - 2. Maintain cementitious materials and aggregates clean, dry and protected against dampness, freezing and foreign matter.

1.5 PROTECTION

- A. Protection During Erection:
 - 1. Maintain protective boards at exposed external corners which may be damaged by construction activities. Provide such protection without damaging completed work.
 - 2. At end of each day's work, cover top of walls with heavy waterproof sheets. Extend sheets 24 inches each side of walls. Secure in place.
 - 3. Cover partially completed structures when work is not in place.

- B. Cold Weather Protection for Work in Progress:
 - 1. When air temperature is from 40 degrees F to 32 degrees F, heat sand and mixing water to produce mortar temperature between 40 degrees F and 120 degrees F.
 - 2. When air temperature is from 32 degrees F to 20 degrees F, heat sand and mixing water to produce mortar temperature between 40°F and 120°F. Maintain temperature of mortar on boards above freezing.
 - 3. When daily air temperature is from 25°F to 20°F, completely cover blocks with insulating blankets or similar protections.
 - a. Use salamanders or other heat sources on both sides of walls under construction. Use wind breaks when wind is in excess of 15mph.
 - 4. When air temperature is 20°F and below, heat sand and mixing water to produce mortar temperatures between 40°F and 120°F.
 - a. Provide enclosures and auxiliary heat to maintain air temperature above 32°F.
 - b. Do not lay masonry units which have surface temperature of 20°F.
 - 5. Remove ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.

- C. Cold Weather Protection for Completed Work:
 - 1. Provide protection as required to maintain minimum 32°F for a minimum of 24 hours.

- D. Remove all masonry units determined to be frozen or damaged by freezing conditions.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Type: Hollow loadbearing quality concrete masonry units manufactured in accordance with ASTM C90-01, conforming to the following grade:
 - 1. Moisture-controlled units for general use such as exterior walls below and above grade that may or may not be exposed to moisture penetration or the weather, and for interior walls and back-up walls.

- B. Type: Hollow load bearing quality concrete masonry units complying with ASTM C90, for walls requiring fire-resistance rating, furnish Architect with a "Certificate of Compliance" stating the manufacturer of concrete masonry units has complied with requirements of UL Design Numbers indicated on drawings.

2.2 BOND BEAMS

- A. Type: Shall be formed-in-place U-shaped concrete masonry units of same quality as wall units, complete with reinforcing steel and grout.

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1. Reinforcing Steel: Size as indicated on drawings. Where not shown, use No. 4 re-bars, Grade 60/ASTM A615; two per bond beam for 8" walls; four per bond beam for 10" and 12" walls.
2. Grout: Fine type or coarse grout as specified in this section.

2.3 LINTELS

- A. Masonry Lintels:
1. Type: Shall be formed U-shaped concrete masonry units of same quality as wall units, complete with reinforcing steel and grout.
 2. Reinforcing Steel: Shall be of type and size as scheduled on Structural Drawings.
 3. Grout: Fine type or coarse type as specified in this section.
 4. Provide shoring as required for temporary support during construction and curing.

2.4 HORIZONTAL JOINT REINFORCEMENT

- A. General: Horizontal joint reinforcement specified below shall be prefabricated reinforcement for embedment in horizontal mortar joints of masonry, manufactured and welded in 10 foot lengths from cold-drawn steel wire conforming with ASTM A82 requirements
1. Prefabricated Corner and Tees: Required for each type of wall reinforcing.
- B. For Single-Wythe Concrete Masonry Unit Walls:
1. Reinforcement Type: 2-wire system, ladder design.
 2. Wire Gage/Size: Longitudinal wire 9 gage, 9 gage cross rods, width 2" less than concrete masonry unit thickness.
 3. Finish: Hot-dipped galvanized after fabrication, ASTM A153 Class B2.
- C. For Brick/Concrete Masonry Unit Cavity Walls:
1. Reinforcement Type: 2-wire, ladder type, hook and eye, adjustable system.
 2. Wire Gage/Size: Longitudinal wire 9 gage, cross wire with 3/16" ties, width 2" less than concrete masonry unit thickness.
 3. Finish: Hot-dipped galvanized after fabrication, ASTM A153 Class B2.

2.5 MATERIALS

- A. Portland Cement: Type I, ASTM C150 quality, gray color.
- B. Masonry Cement: Not permitted.
- C. Hydrated Lime: ASTM C207 quality, Type S.
- D. Mortar Aggregate: ASTM C144 quality, standard masonry type; clean, dry and free of foreign matter.
1. For color consistency in mortar, sand shall be from a single source. Do not change source during the course of the work.
- E. Water: Clean, free of deleterious materials which will not impair strength or bond.
- F. Calcium Chloride: Is NOT permitted.
- G. Aggregate for Masonry Grout: ASTM C404 quality.

2.6 MORTAR MIXES

- A. Pointing Mortar: Comply with ASTM C270 Proportion Specifications for following mortar type:
 - 1. Type S/1800 psi at 28 days.
- B. Mortar for Loadbearing and Non-Loadbearing Walls: Comply with ASTM C270 Proportion Specifications for following mortar type:
 - 1. Type S/1800 psi at 28 days.

2.7 GROUT MIXES

- A. Fine Grout for Reinforced Masonry:
 - 1. Portland Cement: 1 part.
 - 2. Hydrated Lime: 0 to 1/10 part.
 - 3. Fine Aggregate: 2-1/4 to 3 parts.
- B. Mix with mechanical mixer with sufficient water to the desired consistency in accordance with ASTM C476 Proportion Specifications.
- C. Course Grout for Reinforced Masonry:
 - 1. Portland Cement: 1 part.
 - 2. Hydrated Lime: 0 to 1/10 part.
 - 3. Fine Aggregate: 2-1/4 to 3 parts.
 - 4. Coarse Aggregate: 1 to 2 parts.
- D. Mix with mechanical mixer with sufficient water to the desired consistency in accordance with ASTM C476 Proportion Specifications.
- E. Hand Mixing: Not acceptable.

2.8 MISCELLANEOUS ACCESSORIES

- A. Sealant and Backer Rods: Exterior quality specified in Section 07-9200.
 - 1. Color: To match mortar color.
- B. Preformed Control Joints: Extruded PVC with 70 durometer hardness conforming to ASTM D2240, designed for use in control joints in solid or cavity wall construction.
 - 1. Size and Configuration: As required for compliance with drawings.
- C. Reinforcing Bars: Deformed steel, ASTM A615 quality, Grade 60.
 - 1. Size: As indicated on drawings.

PART 3 - EXECUTION

3.1 MORTAR AND GROUT MIXING

- A. Thoroughly mix mortar and grout ingredients in quantities needed for immediate use in accordance with ASTM C270.
- B. Do not use anti-freeze compounds to lower freezing point of mortar and grout.

- C. If water is lost by evaporation, retemper within two hours of mixing. Do not retemper mortar and grout after two hours of mixing.

3.2 PLACEMENT OF REINFORCEMENT AND ANCHORS

- A. In Horizontal Joints:
 - 1. Place reinforcing at 16" on centers.
 - 2. Lap horizontal reinforcing splices minimum 6 inches.
 - 3. Below Openings: Place reinforcing in first joint below opening. Extend minimum 15 inches each side of opening.
 - 4. Above Openings: Place reinforcing in first two joints above opening. Extend minimum 24 inches each side opening. Extend minimum 24 inches each side opening.
 - 5. Corners & Intersections: Fully reinforce with prefabricated corners and ties. Place in first block joint, then every second block joint.
- B. For Hollow Metal Frames: Build-in anchors and fill metal frames solid with Mortar.

3.3 INSTALLATION OF CONCRETE MASONRY UNITS

- A. General:
 - 1. Do not proceed with concrete masonry unit work until unsatisfactory conditions have been corrected.
 - 2. Do not use cracked and chipped concrete masonry units.
 - 3. Use dry concrete masonry units. Frozen and wet concrete masonry units are not acceptable.
 - 4. Cutting: Use motor-driven masonry saws to cut concrete masonry units to provide straight and true, unchipped edges.
- B. Built-In Work:
 - 1. Verify items built-in by other trades for this work are properly located and sized.
 - 2. As concrete unit masonry work progresses, build-in the items supplied by other trades plumb and true to lines and levels.
 - 3. Cut and fit concrete unit masonry work as required for the work of other trades.
 - 4. Do not build-in organic materials which will be subjected to decomposition or deterioration.
- C. Tolerances:
 - 1. Maximum Variations From Alignment of Columns/Pilasters: 1/4" in 10', 3/8" in 20', 1/2" in 40'.
 - 2. Maximum Variation From Unit to Adjacent Unit: 1/32".
 - 3. Maximum Variation From Plane of Wall: 1/4" in 10', 1/2" in 10' or more.
 - 4. Maximum Variation From Plumb: 1/4" per story non-cumulative, 1/2" in two stories or more.
 - 5. Maximum Variation From Level Coursing: 1/8" in 3', 1/4" in 10', 1/2" in 30'.
 - 6. Maximum Variation of Joint Thickness: 1/8" in 3'.
 - 7. Maximum Variation From Cross Sectional Thickness of Walls: 1/4".
- D. Mortar Joints and Coursing:
 - 1. Establish lines, levels and coursing. Protect from disturbance.
 - 2. Joint Size: 3/8" unless otherwise indicated.
 - 3. Type of Bond: Running bond.

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4. Concave Joints: Use where walls which will remain exposed to view.
 5. Flush Joints: Use where joints are concealed.
 6. Make vertical and horizontal joints equal and of uniform thickness.
 7. Lay concrete masonry units in full bed of mortar properly jointed with other work.
 8. Place concrete masonry units in accordance with lines and levels indicated on drawings.
 9. Fully bond intersections, external and internal corner.
 10. Buttering corners of joints, deep or excessive furrowing of mortar joints is not permitted.
 11. Hold 1/4" space between jambs and sills of windows, doors and other openings for sealant.
 12. Do not shift or tap concrete masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace with new mortar.
- E. Expansion/Control Joints: Unless shown otherwise, locate joints as indicated below.
1. Do not continue horizontal masonry reinforcing across control joints.
 2. Between Concrete Masonry Units and Structural Members: Keep 1/2" control joint free of mortar and other rigid materials.
 3. Place joints 4 feet to 10 feet from each exterior corner of building.
 4. Place Joints approximately every 50 feet o.c. in uninterrupted walls.
 5. Place joints at abutment of wall and columns.
 6. Install joints at locations where wall height or thickness changes by more than 20%.
 7. Place control or expansion joints in supporting structure.
 8. At major openings place joints at end of lintels upward and below at ends of sills downward.
 9. For openings less than 6 feet wide place joints on one side of openings.
 10. For openings more than 6 feet wide place joints at both sides of openings.
 11. Keep expansion/control joints free of mortar and other rigid materials.
 12. Refer to details for structurally reinforced masonry control joints.
- F. At Structural Framing:
1. Isolate masonry partitions from vertical structural framing members control joints, with mortar raked back 1/2 inch.
- G. At Underside of Decking & Structural Members:
1. Where non-bearing masonry partitions extend to underside of decking or structural framing members, stop masonry short 1/2 inch to allow for live load deflection.
 2. Fill gap between top of wall and deck with neoprene sponge horizontal expansion joint filler.
 3. Fill corrugations between metal deck and top of wall where the two intersect with soft closure strips.
- ### 3.4 POINTING AND CLEANING
- A. Remove excess mortar and smears upon completion of masonry work.
1. Clean blocks thoroughly with wire brush.
 2. Do not use acids.
- B. Point or replace defective mortar. Match adjacent work.
- C. Rinse and leave block walls clean and neat.

- D. Properly clean joints scheduled for sealant.

3.5 PLACING STRUCTURAL MASONRY REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1" (whichever is greater).
- C. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 10'.
 - 1. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
- D. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing shown.

Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- E. Provide not less than minimum lap indicated or, if not shown, as required by governing code.
- F. Weld splices where shown. Comply with the requirements of AWS D1.4 for welding materials and procedures.
- G. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- H. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
- I. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar grout, or concrete (if any). Brace tie and support as required to maintain portion and shape during construction and curing of reinforced masonry.
- J. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

3.6 REINFORCED WALLS

- A. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
- B. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
- C. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.
- D. Option: Where all vertical cores are not shown to be grouted, Contractor may elect to fill all vertical cores with grout. In which case, requirements for mortar bedding of cross-webs and closing of core spaces below bond beams do not apply.

3.7 GROUTING

- A. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
- B. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
- C. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.
- D. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 5'. Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation. Place grout in lintels or beams over openings in one continuous pour.
- E. Use "Fine Grout" per ASTM C476 for filling spaces less than 4" in one or both horizontal directions.
- F. Use "Course Grout" per ASTM C476 for filling spaces 4" to 10" in both horizontal directions.
- G. Use 3000 psi concrete for filling spaces 10" or larger in both horizontal directions.

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- H. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to the requirements which follow.
- I. Low-Lift Grouting:
1. Provide minimum clear dimension of 2" and clear area of 8 sq. in. in vertical cores to be grouted.
 2. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required to allow for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 ft.
 3. Lay CMU to maximum pour height. Do not exceed 5' height, or if bond beam occurs below 5' height stop pour at course below bond beam.
 4. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top course of pour.
 5. Bond Beams: Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.
- J. High-Lift Grouting:
1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension is 3" and 10 sq. in., respectively.
 2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
 3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
- K. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1" of vertically reinforced cavities, during construction of masonry.
- L. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

END OF SECTION

MANUFACTURED STONE MASONRY (STONE VENEER) 04-7300-1

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SECTION 04-7300 MANUFACTURED STONE MASONRY (STONE VENEER)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manufactured Stone Systems
 - 1. Interior: Dry-stack installations at Fireplace.

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Product Data: Submit manufacturer's technical data for each type of stone, stonework, metal lath and mortar.
- C. Shop Drawings: Submit drawings indicating sizes, dimensions, sections and profiles of stones; arrangement and provisions for jointing, trim details and details showing relationship with adjacent work.
- D. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- E. Samples: Submit the following:
 - 1. Two 16" x 16" samples for architect's approval for color and finish of stone required.
 - 2. Colored pointing mortar and grout samples.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in fabricating stone material, similar to that specified, with five years minimum experience.
- B. Installer: Stonework shall be performed by a firm with a minimum of three years of successful experience in the type of work specified in this section.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver manufactured stone materials to project in accordance with manufacturer's recommendations and Section 01-6600.
- B. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, breakage, chipping, or other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURED STONE

- A. Type: Manufactured by Mountain Stone, www.mtstone.com or approved substitute.
 - 1. Type, Size, Color, Texture: As indicated on Elevation Drawings.
 - 2. Substitutions: The following manufacturers are acceptable subject to requirements of this Section. Other manufacturers may be submitted for review in accordance with Section 01-2513:
 - a. Owens Corning, Cultured Stone, www.culturedstone.com
 - b. Centurion Stone, www.centurionstone.com

2.2 MORTAR

MANUFACTURED STONE MASONRY (STONE VENEER) 04-7300-2

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- A. Bonding Mortar:
 - 1. Mortar: Type S, premixed
 - 2. Sand: Clean brick
 - 3. Water: Clean, non-alkaline and potable.
 - 4. Mix: Use proportions recommended by premixed mortar manufacturer.
 - 5. Use: For covering metal lath and adhering stone only.

2.3 ACCESSORIES

- A. Metal Lath: .5 lb (1.4 kg/m²) galvanized expanded metal lath.
- B. Metal Lath Fasteners for Metal Studs: Minimum 7/16 inch (11.1 mm) head diameter, corrosion-resistant, self-drilling, self tapping, pancake head screws of sufficient length to penetrate 3/8 inch (10 mm) minimum into the stud.
- C. Cleaning Solution: As recommended or approved by stone manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer shall verify that building structure and site conditions are ready to receive stonework and shall report in writing any conditions that are not in compliance with requirements.
- B. Prior to installation of metal lath and stonework contractor shall verify exterior sheathing has been taped, sealed and waterproofed according to project specifications.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean stone surfaces which have become dirty or stained prior to setting by thoroughly scrubbing with fiber brushes followed by a thorough drenching with clear water.

3.3 INSTALLATION

- A. General: Install components of system following manufacturer instructions.
- B. Use power saws to cut stones; for exposed edges, produce edges which are cut straight and true.
 - 1. Use skilled brick masons at the site to do necessary field cutting as stones are set.
- C. Interior installations: Install metal lath, bonding mortar and stones.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace stonework which is broken, chipped, and stained and with defective joints and stones and joints not matching approved samples and field-constructed mock-ups.
- B. Replace in manner which results in stonework showing no evidence of replacement.
- C. Clean stonework within time-frames, and using methods recommended by grout and stone manufacturers.

3.5 PROTECTION

MANUFACTURED STONE MASONRY (STONE VENEER) 04-7300-3
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- A. Protect and maintain conditions, in a manner acceptable to Architect and Owner.

END OF SECTION

SECTION 05-4100
STRUCTURAL METAL STUD FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cold-formed load-bearing steel stud exterior wall and soffit framing, with anchorage and bracing, to comply with applicable building codes.
- B. Synthetic rubber tape and primer for installation under exterior stud tracks.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Clearly describing quality, performance and finish for steel studs.
 - 2. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
 - 3. Shop Drawings: Submit shop drawings bearing the seal and signature of a professional structural engineer licensed in the State in which the project is located. Include design calculations.

1.3 QUALITY ASSURANCE

- A. Perform exterior metal stud work in accordance with stud manufacturer's published installation instructions.
 - 1. Seismic Requirements:
 - a. Comply with applicable tables, charts, Cp values, importance factors, and other requirements.
 - b. Use construction methods required to meet seismic requirements.
 - c. Refer to Architectural and Structural Drawings for special seismic attachment requirements and details.
- B. Furnish members and accessories by one manufacturer only.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in accordance with manufacturer's recommendations bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 EXTERIOR STEEL STUDS

- A. Type: Cee steel stud ASTM C955 with 1-5/8" knurled flange and 1/2" return lip, punched web. Un-punched webs are not acceptable except at exterior door and window openings.

STRUCTURAL METAL STUD FRAMING 05-4100-2
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1. Finish: Hot-dipped galvanized, ASTM A653, G90 Coating.
- B. Effective Section Properties
 1. Wall Studs w/ Fiber Cement Siding:
 - a. Size: 6 inches, 14 gage.
 - b. Section Modulus: 1.218 in³ minimum.
 - c. Moment of Inertia: 3.679 in⁴ minimum.
 2. Soffit Framing:
 - a. Size: 3-5/8 inches, 16 gage.
 - b. Section Modulus: .486 in³ minimum.
 - c. Moment of Inertia: .893 in⁴ minimum.
- C. Acceptable Manufacturers: Subject to requirements of this section, products of the following manufacturers are acceptable. Products of other manufacturers may be submitted for review in accordance with Section 01-2513.
 1. Studco, www.studco.com
 2. Clark Western Building Systems, www.clarksteel.com
 3. Consolidated Fabricators Corp. Building Products Division, www.confabbpd.com
 4. Dietrich Metal Framing, www.dietrichindustries.com

2.2 ACCESSORIES

- A. Bridging, Bracing, Furring: Formed sheet steel, ASTM A36, Grade A.
 1. Manufacturers standard shapes.
 2. Finish: Same as studs.
 3. Gage and profile determined by conditions encountered.
- B. Tracks: Deep leg type, ASTM A955, Grade A, unpunched, same gage and finish as studs.
- C. Plates, Gussets, Clips: Formed sheet steel, thickness determined by conditions encountered, manufacturer's standard shapes. Finish same as studs.
- D. Self-drilling, Self-tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized, ASTM A653, G90 Coating.
 1. Screws: 1" Type S-12
- E. Anchorage Devices: Power driven or power actuated, drilled expansion bolts; or screws with sleeves.
- F. Welding: AWS D1.1 Structural Welding Code.
- G. Synthetic Rubber or Elastomeric Tape:
 1. Width: Single or double piece overlapped to provide 7" width.
 2. Primer for Synthetic Rubber Tape: Provide if recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove dust and other foreign material from concrete slab edge by brooming and wiping to provide a clean surface to receive rubber tape and primer.

3.2 ERECTION

- A. General:
 - 1. Make provisions for erection stresses. Provide temporary alignment and bracing.
 - 2. Brace and reinforce studs to develop full strength to meet design requirements.
 - 3. Erect studs one piece full length. Splicing of framing components with screws and wire ties is not acceptable.
 - 4. Touch-up field welds and scratched or damaged galvanized finish to studs, bracing, furring, bridging, and runners according to ASTM A780 specifications.
- B. Stud Spacings: As indicated on shop drawings.
- C. Stud Tracks: Before installing stud tracks for exterior walls, apply primer and synthetic rubber tape longitudinally under stud tracks to seal runner to floor.
 - 1. Secure stud tracks to floor slab as shown on shop drawings.
- D. Door Openings: Install double studs with un-punched webs each side of door openings.
 - 1. Install double studs horizontally between door jambs at top of doors.
 - 2. On top of headers, install runners to receive bottom ends of studs over door openings.
 - 3. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- E. Window Openings: Install double studs with un-punched webs each side of window openings.
 - 1. Install double studs horizontally between window jambs to form sills and headers.
 - 2. On top of headers and bottom of sills, install runners to receive short studs.
 - 3. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- F. Corners: Construct using minimum three studs.
- G. Between Studs: Install framing for attachment of electrical boxes, mechanical and for other items to be anchored to walls.
- H. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as recommended by USG.
- I. At Butting Walls: Place studs not more than 2 inches from walls.
- J. Soffits: Install stud framing to comply with wind loading and design requirements.
 - 1. Stud Spacing: 16" o.c. maximum.
 - 2. Secure stud framing to runners or support studs with screws.

STRUCTURAL METAL STUD FRAMING 05-4100-4
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END OF SECTION

SECTION 05-4523
HEALTHCARE METAL SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Medical support system as indicated on the architectural plans and Owner provided vendor drawings with accessories for a complete installation.
- B. Medical support system for Radiology equipment.
- C. Layout is subject to change once Owner purchases equipment and provides final vendor drawings.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Prepared and stamped by engineer licensed in the state of where project is located. Clearly indicate:
 - a. Plan layout of system at 1/4" = 1'-0" scale.
 - b. Typical Elevations.
 - c. Details and anchoring methods.
 - d. Structural calculations which verify adequacy of the design for gravity and other required loads, including earthquake loads.
 - 2. Manufacturer's Product Data: Indicating full compliance with requirements of this section, installation instructions, and including engineering information for calculating stresses and for verifying the strength of individual members or components.
 - 3. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100

1.3 QUALITY ASSURANCE

- A. Manufacturer: Provide medical support system produced by a single manufacturer with not less than five years successful experience in the design, fabrication and installation of systems of the type and quality specified in this section.

1.4 SYSTEM DESCRIPTION

- A. System shall be designed and installed as required to meet equipment manufacturer's requirements.
- B. System shall comply with Owner's final vendor drawing requirements.

1.5 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels and in accordance with 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Manufacturer: UNISTRUT Construction, [www.unistrutconstruction](http://www.unistrutconstruction.com)
- B. Substitutions: Products of the following manufacturers are acceptable:
 - 1. Cooper B-Line Support Systems, www.b-line.com
 - 2. Power Engineering Co., Inc. (Powerstrut Products), www.powerstrut.com
- C. Materials: Conform to the following specifications:
 - 1. ASTM A446 Grade A, G90.
 - 2. ASTM A570 Grade 33.
 - 3. ASTM A575 Grade 50.
 - 4. ASTM 675 Grade 50, SAE J429, Grade 2.
- D. Design:
 - 1. Support Structure: Support members at the ceiling plane shall be located as indicated on shop drawings. Provide for equipment to be attached at any point along the support members without drilling into support system or welding to same.
 - 2. Ceiling Anchorage: Wherever possible attachment to ceiling shall be imbedded concrete inserts, through bolts, or direct attachment to structural framing.
 - 3. Loading: The support structure shall be designed to support a concentrated load of 2000 minimum pounds at any point along all equipment rails, unless greater load is required by Owner's vendor drawings.
 - 4. Safety Factor: Support structure shall be designed for a minimum safety factor of 3 based on the ultimate strength under static loading conditions. Deflection shall not exceed 1/720 span in either plane under maximal loading conditions.
 - 5. Seismic Bracing: Comply with applicable tables, charts, Cp values, importance factors, and other requirements as indicated in the Drawings.
- E. Finish: All members and connections shall be coated with a corrosion resistant finish. Hardware shall be electro-galvanized.
 - 1. Safety Factor: Support structure shall be designed for a minimum safety factor of 3 based on the ultimate strength under static loading conditions. Deflection shall not exceed 1/720 span in either plane under maximal loading conditions.
 - 2. Seismic Bracing: Comply with applicable tables, charts, Cp values, importance factors, and other requirements.
 - a. Comply with applicable Building Code latest edition.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Verify that surface conditions are ready to receive work.
- B. Coordinate the layout of ceiling anchorage with other work above ceiling.
- C. Beginning medical support system work means acceptance of existing conditions.

3.2 **INSTALLATION**

A. **General:**

1. Install supporting framework plumb and true and to the following tolerances:
 - a. The mounting surfaces of the support structure shall be horizontal within the tolerance of 1/32" in 24 inches and within 1/16" in 18 foot length.
 - b. The elevation of one rail mounting surface to the other shall be within 1/16" in any 24" length of the rails.

B. **Installation:**

1. The medical support structure shall be installed in full accordance with approved shop drawings. Any modification shall be reported to the Architect.

END OF SECTION

SECTION 05-5000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Miscellaneous shop-fabricated metal items as required to complete the work of this project.
- B. Metal counter brackets are specified under Interior Architectural Woodwork Section 06-4023.

1.2 QUALITY ASSURANCE

- A. Shop Assembly:
 - 1. Items shall be assembled in the shop to the extent possible to minimize field-splicing and assembly.
 - 2. Items shall be disassembled only as necessary for shipping and handling.
 - 3. Items shall be marked for re-assembly and coordinated installation.
- B. Work performed in this Section which will become part of the work of other Sections must be closely coordinated to meet the requirements of the particular work.
 - 1. Example: Requirements for welded and bolted connections for structural steel work, steel joists, metal decking, etc. must be complied with.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Clearly indicate:
 - a. Fabrication and erection requirements for miscellaneous metal fabrications required to complete the work of this project.
 - b. Profiles, sizes, spacings and locations of structural members, type of connections.
 - c. Welded connections using standard AWS welding symbols including net weld lengths.
 - d. Where materials or fabrications are indicated to comply with certain requirements for design loadings, include structural computations, material properties and other information needed for structural analysis.
 - e. Reproduction of structural drawings for shop drawings is not acceptable. Submittal will be returned unreviewed.
 - f. Include erection drawings, elevations and details where applicable.
 - 2. Templates: Provide for anchor and bolt installation by others.
 - 3. Certifications:
 - a. Upon request by Architect, submit mill certificates certifying that steel supplied meets requirements of these specifications and referenced standards specified in this Section.
 - b. Certification from fabricator that shop fabricated items comply with Americans with Disabilities Act for Accessibility.

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- C. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY AND STORAGE

- A. Miscellaneous metal fabrications shall be delivered to and stored at the job-site in accordance with Sections 01-6500 and 01-6600.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ferrous Metals:
 - 1. Steel Plates, Shapes, and Bars: ASTM A36.
 - 2. Steel Tubing: ASTM A500, Grade B, cold-formed..
 - 3. Structural Steel Sheet: Cold-Rolled ASTM A611; or Hot-Rolled ASTM A570, Class 1; grade as required by design loading.
 - 4. Galvanized Structural Steel Sheet: ASTM A446; Grade A, of grade required for design loading; G90 coating.
 - 5. Steel Pipe: ASTM A153; Schedule 60, black. Galvanized finish for exterior installations and where indicated.
 - 6. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Bolts, washers, and shims as required, hot-dip galvanized per ASTM A153.
 - 7. Welding Rods and Bare Electrodes: In accordance with AWS specifications for the metal alloy to be welded.
- B. Grout:
 - 1. Type: Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- C. Fasteners:
 - 1. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.
 - 2. Lag Bolts: Square head type, FS FF-B-561.
 - 3. Machine Screws: Cadmium plated steel, FS FF-S-92.
 - 4. Wood Screws: Flat head carbon steel, FS FF-S-111.
 - 5. Plain Washers: Round, carbon steel, FS FF-W-92.
 - 6. Drilled-In Expansion Anchors: FS FF-S-325, Group VIII (anchors, expansion, nondrilling), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.
 - 7. Toggle Bolts: Tumble-Wing type, FS FF-B-588, type, class, and style as required.
 - 8. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

2.2 FABRICATION

- A. Fabricate structural steel items in accordance with approved shop drawings, recommendations of American Institute of Steel Construction (AISC) and ADA where applicable.
 - 1. For structural steel work, comply with Structural Engineer's design requirements.
- B. Verify dimensions on site prior to shop fabrication.

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- C. Fabricate items with joints tightly fitted and secured.
- D. Weld or rivet all permanent connections.
- E. Fit and shop assemble in largest practical Sections, for delivery to site.
- F. Form joints exposed to weather to exclude water.
- G. Exposed Welds: Grind flush and smooth with adjacent finished surface.
 - 1. Exposed Edges: Ease to small uniform radius.
- H. Provide holes and connections for work of other trades.
- I. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
- J. Exposed Butt Joints: Make tight, flush and hairline.
- K. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.
- L. Castings shall be uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects.

2.3 FINISH

- A. Clean surfaces of rust, scale, grease and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact bond with concrete or where field welding is required.
- C. All miscellaneous metal fabrications shall be primed with one coat of primer complying with quality requirements of Structural Steel Painting Council (SSPC).
- D. Items scheduled to be galvanized shall be hot-dipped galvanized after fabrication with 1.25 oz/sq.ft. in accordance with ASTM A123.
 - 1. All exterior steel loose lintels and bent plates exposed to view and/or the weather shall be galvanized.

2.4 SCHEDULE

- A. Provide and install miscellaneous framing, supports, trim and other shop-fabricated items as required to complete the work, including items shown on drawings and listed in the following schedule.
 - 1. The Schedule is a list of principal items only. Refer to Drawings for items not specifically scheduled.
- B. For Roofing Work:
 - 1. Steel angles and bent plates at roof edges and openings. Refer to Mechanical and Electrical drawings for additional openings.
 - 2. Loose steel angles for reinforcing metal deck.

- C. For Masonry Work: Structural steel lintels for openings and recesses in masonry walls and partitions as indicated.
- D. Interior Ladder:
 - 1. Side Rails: Continuous structural steel flat bars with eased edges, spaced 18" apart.
 - 2. Rungs: 1" diameter solid structural steel spaced 12" o.c., welded to side rails, complete with slip-resistant finish of aluminum oxide granules set in epoxy resin adhesive. Prefinished manufactured slip-resistant rungs are acceptable.
 - 3. Ladder Supports: Structural steel brackets sized for adequate support, welded to side rails, designed to hold ladder clear of wall 7" from center of rungs. Locate ladder supports at top and bottom, and at intermediate points spaced not more than 5' o.c.
 - 4. Finish: Hot-dipped galvanized.
- E. Mechanical room crawl space access grate cover with cutouts for lifting.
- F. Bearing and Leveling Plates:
 - 1. Where required for steel items bearing on masonry or concrete construction, fabricate plates flat and free from warps or twists, complete with holes for anchor bolts.
 - 2. Finish: Paint primed for interior installations. Hot-dipped galvanized for exterior installations.
- G. Guardrails at exterior bi-folding automatic doors, as indicated on architectural drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Obtain Architect's approval prior to site cutting or making adjustments not scheduled.
- B. Where site welding is scheduled, clean and strip primed steel items to bare metal.
- C. Make provision for erection loads with temporary bracing. Keep work in alignment.
- D. Coordinate the work of this Section with the appropriate trades.
 - 1. Supply the appropriate items to the trades.

3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects. Comply with approved shop drawings.
- B. Field Welding: Perform in accordance with AWS D1.1.
- C. After installation, touch-up field welds, scratched or damaged surfaces with primer.

END OF SECTION

SECTION 06-1000
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Miscellaneous rough carpentry as required to complete the work of this project.
- B. Blocking and nailers for roof system and related flashings.
- C. Blocking in metal stud/gypsum board walls.
- D. Blocking above suspended ceiling level for support of equipment tracks.
- E. Plywood panels for mounting electrical and telephone equipment.
- F. Plywood panels for backside of parapets to receive roof flashing.

1.2 QUALITY ASSURANCE

- A. Rough carpentry lumber shall bear visible grade stamps of agency certified by National Forest Products Association (NFPA).
- B. Preservative Treatment by Pressure Process: ACQ Preserve lumber and plywood requirements for preservative treatment. Treatment plant shall be licensed by manufacturer of treated material.
 - 1. Wood nailers used for the attachment of EPDM roofing shall be pressure treated only with salt preservatives. Certification from manufacturer substantiating this requirement is required.

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- C. Certification of Treating Plant:
 - 1. Wood Preservatives: Submit certificate stating water-borne chemical and process used, net amount of preservative retained, and compliance with applicable standards. Include statement that moisture content of treated lumber was reduced to a maximum of 19% and plywood to 15% prior to shipment to site.
 - 2. Water-Borne Treatment: Statement that moisture content of treated materials was reduced to levels indicated under 2.1, A.1, prior to shipment to project site.
 - 3. Fire-Retardant Treatment: Submit certificate stating that fire-retardant treatment materials comply with governing ordinances and meet or exceed requirements for ASTM D5516 and ASTM D5664 tests. Include a statement that treatment will not bleed through finish surfaces or corrode metal fasteners. List materials manufacturer by full name and address.

1.3 DELIVERY, STORAGE, HANDLING

- A. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces.
 - 1. Stack lumber and plywood in a way to provide air circulation within stacks.
 - 2. Comply with provisions of Sections 01-6500 and 01-6600.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber and timber shall be sound, thoroughly seasoned and well manufactured in compliance with NFPA "National Design Specifications " for Stress Grade Lumber and its Fastenings."
 - 1. Each piece of lumber shall bear an identification stamp of the accredited test agency. Maximum moisture content: 19%.
- B. Decay/Insect Resistant Lumber: Southern Pine; SPIB, construction or No. 2 grade, pressure-treated, clear.
 - 1. Sizes: As indicated on drawings.
- C. Fire-Retardant Lumber: Southern Pine No. 2, complying with AWPA C20.
 - 1. Sizes: As indicated on drawings.
- D. Plywood Panels: Exterior Grade Plywood, APA rated, span rating as required to suit joist spacing indicated.
 - 1. Thickness: 3/4 inch
- E. Plywood Backing Panels for Mounting Electrical or Telephone Equipment: DOC PSI, Exposure I, fire-retardant treated plywood panels, C-D PLUGGED with exterior glue, 1/2 inch minimum thickness.
- F. Nails, Spikes and Staples: Steel: Size and type to suit application.
 - 1. Stainless Steel type 304 or 316 for exterior location, high humidity locations and treated wood.
 - 2. Use stainless steel or brass to mount wall-hung items on treated wood blocking.
 - 3. Plain finish for other interior locations.
 - 4. Electro galvanizing is not acceptable.
- G. Bolts, Nuts, Washers, Lags and Screws: Steel; size and type to suit application.
 - 1. Stainless steel or hot-dipped galvanized for exterior locations, high humidity locations, and treated wood.
 - 2. Use stainless steel or hot-dipped galvanized to mount wall-hung items on treated wood blocking.
 - 3. Plain finish for other interior locations.
 - 4. Electro galvanizing is not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

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- A. Discard material with defects which might impair quality of work and too small to use in fabricating work with minimum joints.
- B. Set work to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening and as required by recognized standards.
- D. Countersink nail heads on exposed carpentry work and fill holes.
- E. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.
- F. Place miscellaneous blocking, furring and roof cants true to lines and levels. Secure rigidly in place.
- G. Locations of Use for Decay and Insect Resistant Lumber:
 - 1. Where not required to be fire-retardant, use pressure-treated decay and insect resistant lumber for blockings and nailing strips in contact with concrete, roofing and steel. Do not let this type of lumber make contact with items containing oil-based preservatives.
 - 2. Apply two drenching coats of specified preservative to job-cut edges of lumber.
- H. Locations of Use for Fire-Retardant Lumber:
 - 1. Use pressure-treated fire-retardant lumber for all framing, blocking and nailing strips on interior of building.
 - 2. Apply two drenching coats of specified preservative to job-cut edges of lumber.
- I. Locations of Use for Fire-Retardant Plywood:
 - 1. Use fire-retardant plywood where plywood is called for on drawings and fire-retardant construction is required by code.
 - 2. Unless indicated otherwise use for mounting wall-mounted doorstops, handrails, and similar items.
- J. In Metal Stud Walls:
 - 1. Install fire-retardant wood blockings, framing and nailing strips in metal stud walls to provide strong support for items to be attached to walls such as cabinets, railings, plumbing fixtures, mechanical and electrical items.
 - 2. Coordinate the requirements for plumbing, mechanical and electrical items with appropriate contractors.
- K. Back-Up Panels for Electrical and Telephone Equipment:
 - 1. At metal stud/gypsum board walls, install fire-retardant plywood as back-up panels for electrical and telephone equipment, size as required.
 - 2. Attachment for Metal Studs: Self-drilling, self-tapping screws 12 inches o.c. at each stud.
- L. Wood Blocking to Steel Members:
 - 1. Secure wood blocking to steel members at 24 inches o.c. with machine bolts, washers, lock washers and nuts, unless otherwise indicated.

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2. Bore and counterbore wood members to keep surfaces free of projections.
 3. When steel members are not drilled in shop, drill the holes at 24 inches o.c., unless otherwise indicated.
- M. Wood Blocking for Roofing Work:
1. Install decay/insect resistant lumber. Secure in place as indicated on drawings.
 2. Where blocking is installed over steel members, span wood blocking across joints of steel members at least 24".
 3. Install a bolt at each end of each blocking member 3" from end.

END OF SECTION

SECTION 06-1643
GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Gypsum board sheathing for installation on exterior metal wall studs.
- B. Gypsum soffit sheathing.
- C. Breathable membrane air barriers and weather retarders for installing over gypsum board sheathing in wall construction.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Firm with minimum five years experience in successfully producing gypsum sheathing similar to that indicated for this project.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's product data indicating full compliance with requirements of this Section.

1.4 JOB MOCK-UP

- A. Mock-Up Panel: Before work in this section is started, provide exterior mock-up for Owner and Architect review and approval of all exterior finish elements materials and construction manner. Comply with provisions of Section 01-3323.

1.5 PRE-INSTALLATION CONFERENCE

- A. Prior to starting roofing and exterior envelope work, the General Contractor shall set up a job site meeting to comply with provisions of Section 01-3119 for the "Envelope and Roofing Pre-Installation Conference".

1.6 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels.
 - 1. Comply with Section 01-6500.
- B. Store materials inside, under cover, in a dry place.
 - 1. Stack gypsum board flat, off floor, on boards.
 - 2. Support gypsum boards to prevent sagging.
 - 3. Comply with Section 01-6600.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Provide products manufactured by Georgia Pacific, www.gp.com
 - 1. Substitutions: Products by the following manufacturers are acceptable:
 - a. Certaineed, www.bpb-na.com,
 - b. Temple Inland Inc., www.templeinland.com

2.2 WALL SHEATHING

- A. Product: Dens-Glass Gold, manufactured by Georgia Pacific, www.gp.com
 - 1. Substitutions: Products by the following manufacturers are acceptable:
 - a. Certaineed, www.bpb-na.com, GlasRoc
 - b. Temple Inland Inc., www.templeinland.com, Greenglass
- B. Type: Type X, gypsum sheathing, square-edged water and fire resistant, silicone-treated core penetrated by fiberglass mats both sides complying with ASTM C1177.
 - 1. Width: 48 inches.
 - 2. Thickness: 5/8 inch.

2.3 SOFFIT SHEATHING

- A. Type: Dens-Glass Gold, Type X, gypsum sheathing, square-edged water- and fire-resistant, silicone-treated core penetrated by fiberglass mats both sides complying with ASTM C1179.
 - 1. Width: 48".
 - 2. Thickness: 1/2".
 - 3. Use: Do not use where the probability of a roof leak could divert water to the sheathing board.

2.4 SHEATHING ACCESSORIES

- A. Screws: For fastening to metal, use 1-1/4 inch minimum #6, self-tapping, Type S bugle head, corrosion-resistant screws complying with ASTM C646, unless otherwise recommended by gypsum board manufacturer.
- B. Nails: For fastening into wood use 11 gage, 7/16 inch head galvanized nails, 1-1/2 inch long for 1/2 inch sheathing and 1-3/4 inch long for 5/8 inch sheathing.
- C. Damproofing: Emulsified asphalt dampproofing as specified in Section 07-1113.
- D. Sealant, Tape and Joint Filler for Sheathing: As recommended by sheathing manufacturer as being compatible with specified gypsum sheathing board.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform sheathing work in accordance with manufacturer's recommendations.
- B. Sheathing Application:

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1. Install with gold side out in maximum lengths possible to minimize number of joints.
 2. Locate edge joints parallel to and located on framing.
 3. Stagger intermediate end joints of adjacent lengths of sheathing.
 4. For metal framing space screws 8" o.c. at perimeter and 8" o.c. in field.
 5. Drive fasteners to bear tight against surface of sheathing. Do not countersink.
 6. Locate fasteners 3/8" minimum from edges and ends of sheathing panels.
- C. Soffit Sheathing Application:
1. Install exterior sheathing board perpendicular to supports, stagger end joints over supports. Coordinate with location of soffit vents.
 2. Install with 1/4 inch open space where boards abut other work.
 3. Space screws 4 inches o.c. around perimeter of board and 8 inches o.c. on intermediate framing members and on diagonal braces.
- D. Sealant and Joint Filler Applications at Walls:
1. Apply compatible joint sealant recommended by sheathing manufacturer and tape to all joints in sheathing and at perimeters interfacing with other materials.
- E. Sealant and Joint Filler Applications at Soffits:
1. Apply at all joints, edges and openings as recommended by sheathing manufacturer to provide a complete moisture and air seal.
 2. At all joints 1/8 inch and larger in gypsum sheathing use a backer rod.
- F. Install flashing as indicated on drawings and specified in Section 07-6507.
- G. Apply sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel sealant to embed sealant in entire face of tape. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION

SECTION 06-2000
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Finish carpentry items, other than shop-fabricated millwork.
- B. Installation of metal and wood doors.
 - 1. Coordinate with requirements in Section 08-1113 and 08-1400.
- C. Installation of hardware and attachment accessories.
 - 1. Coordinate with requirements in Section 08-7100.
- D. Installation of countertops and steel brackets.
- E. Installation of shop-fabricated millwork.
- F. Calking countertops and backsplash.

1.2 QUALITY ASSURANCE

- A. Throughout the progress of the work of this Section, provide at least one person completely trained and experienced in the necessary skills to become thoroughly familiar with the specified requirements, and be present at the site at all times to direct all work required under this Section.
- B. Fire-retardant treated wood shall conform to applicable requirements of AWPA and NFPA.
- C. Indicated fire resistance assembly rating shall conform to UL requirements.

1.3 DELIVERY, HANDLING, STORAGE

- A. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces.
- B. Comply with provisions of Section 01-6500 and 01-6600.
- C. Do not install finish carpentry work before building is closed in and temperature and humidity stabilized.
- D. Store materials in area of installation for three days prior to installation.
- E. In the event of damage, immediately make all repairs and replacements necessary to meet Architect's approval.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.

- B. Manufacturer's product data on fire-retardant treatment and applicable instructions and on wood preservative treatment.
- C. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

PART 2 – PRODUCTS**2.1 ACCESSORIES**

- A. Adhesives: Water base or solvent type as recommended by manufacturer of material being installed.
- B. Fasteners: Size and type to suit application; galvanized or stainless steel exposed to moisture or corrosive conditions.
- C. Wood Filler: Oil or solvent base, tinted to match surface finish color.
- D. Caulk: Clear silicone sealant by Pecora, Dow, or GE at following locations:
 - 1. At backsplash and wall.
 - 2. Between backsplash and countertop.
 - 3. Around fixtures recessed into countertop.

2.2 FABRICATION

- A. Fabricate to AWI Standards.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Verify mechanical, electrical, and building items affecting this Section are placed and ready to receive this work.
- B. Verify field dimensions.
- C. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.
- D. Backprime lumber for painted finish exposed on the exterior or to moisture and high relative humidities on the interior. Comply with requirements of Section 09-9100.

3.2 INSTALLATION

- A. Discard material which is unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements.
- B. Install work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level countertops; 1/16" maximum variation from true position and 1/32" maximum offset from true alignment with abutting materials.

- C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- D. Apply plastic laminate finishes where indicated. Adhere with adhesive over entire surface. Make joints and corners hairline. Match patterns. Slightly bevel arises.
- E. Anchorage: Secure finish work to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed nailings, countersunk and filled flush with finished surface. Use hot-dipped galvanized nails for attaching finish work to treated grounds.
- F. Countertops:
 - 1. Install countertops at heights to comply with ADA requirements.
 - 2. Attach countertops to wood blocking, and steel counter brackets, if indicated, from underside with screws. All fasteners shall be concealed.
 - 3. Attach steel counter brackets to walls with toggle bolts.
 - 4. Drill through gypsum board and legs of steel studs.
 - 5. Install toggle bolts so that the wings of toggle nut bears against the inside of steel studs and/or wood blocking.
 - 6. Calk between countertop and backsplash and at dissimilar materials with clear silicone sealant.

3.3 DOOR INSTALLATION

- A. Verify frame opening dimensions.
- B. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.
- C. Install doors in accordance with manufacturer's instruction and AWI quality standards.
- D. Install work plumb, level, true and straight with no distortions. Conform to AWI requirements for fit and clearance tolerances. Conform to AWI Section 1300 requirements for maximum diagonal distortion.
- E. Trim wood doors by cutting equally on both jamb edges.
- F. Trim wood door height by cutting bottom edges to a maximum of 3/4". Trim fire door height at bottom edge only.

3.4 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

- A. Repair damaged and defective finish carpentry work. Where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.
- C. Protection: Protect and maintain conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

SECTION 06-4013
EXTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Cedar wood brackets and trim.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Installation of architectural woodwork shall be performed by a firm that can demonstrate three years successful experience in installing architectural woodwork items similar in type and quality to those required for this project.
- B. AWS Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3000.
- B. Shop Drawings: Shall be of sufficient scale and detail to determine compliance with the AWI requirements and these specifications, including the following:
 - 1. Plan and elevation views, fully dimensioned at 1/4" = 1'-0" minimum.
 - 2. Sections and Details at 3" = 1'-0" minimum.
 - 3. Any hardware and miscellaneous items required to complete this work.
 - 4. Type and quality of finishes.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration in accordance with Section 01-6500 and 01-6600.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Woodwork materials shall comply with requirements of the AWS woodworking standard for each type of woodwork and quality grade indicated.

2.2 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated.

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- C. Complete fabrication, including assembly and finishing, before shipment to project site to extent possible. Disassemble components as necessary for shipment and installation.

2.3 EXTERIOR WOOD BRACKETS AND TRIM

- A. Quality Standard: AWS Section 100.
- B. Grade: Custom.
- C. Lumber Species for Stained Finish: Cedar
- D. Sizes and configurations as indicated on Drawings.

2.4 FASTENERS AND ANCHORS

- A. Screws: Comply with FS FF-S-111.
- B. Nails: Comply with FS FF-N-105.
- C. Anchors: Provide stainless steel anchors and inserts on inside face of exterior walls and where required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors to be set into concrete or masonry work for woodwork anchorage.

2.5 FINISHING

- A. Comply with AWS Section 01500 and Section 09-9100 to match Architect's sample.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and back priming.

3.2 INSTALLATION

- A. Comply with AWS Section 1700.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Anchor woodwork to blocking attached to substrates. Secure with countersunk, concealed fasteners and blind nailing for a complete installation. Where prefinished

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matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish.

- E. Refer to SECTION 09-9100 for back priming and final finish of installed architectural woodwork.

3.3 **ADJUSTMENT AND CLEANING**

- A. Repair damaged and defective woodwork to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.4 **PROTECTION**

- A. Provide protection and maintain conditions, in a manner acceptable to manufacturer and installer.

END OF SECTION

SECTION 06-4023
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Interior running trim as indicated on drawings.
- B. Laminate clad cabinets (plastic-covered wood cabinets).
- C. Cabinet Tops (countertops).
- D. Cabinet hardware and accessory items not part of Door Hardware Division 8.
- E. Solid Surface Window Sills

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm with minimum five years experience in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
 - 1. Architect reserves the right to approve the woodwork manufacturer selected to finish the work of this Section.
- B. Installer Qualifications: Installation of interior architectural woodwork shall be performed by a firm that can demonstrate three years successful experience in installing woodwork similar to that required for this project.
- C. AWI Quality Standard: Company with "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute (AWI) which are by reference made a part of this specification.
 - 1. Any reference to Custom Grade in this specification shall be as defined in the AWI publication "Architectural Woodwork Quality Standards", latest edition.
 - 2. Any item not given a specific quality grade shall be Custom Grade as defined in AWI publication, latest edition.
- D. All homogeneous solid surface work shall be performed by a Manufacturer Certified fabricator.
- E. Coordinate hardware requirements with cabinet shop drawings and fabrication and with Section 08-7100 - Door Hardware.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Shop Drawings: Shall be of sufficient scale and detail to determine compliance with the AWI requirements and these specifications, including the following:
 - 1. Elevations and plan views of the required work, fully dimensioned: 1/4" = 1'-0".
 - 2. Size and type of framing materials, Section: 3" = 1'-0".
 - 3. All cabinet hardware & miscellaneous items required to complete this work.
 - 4. Type and quality of finishes.
- C. Samples of the following:
 - 4. Plastic laminate for texture and color selections.

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- 5. Cabinet hardware (1 of each type), if requested.
 - 3. Homogeneous hard surface material (6" x 6").
 - D. Manufacturer's product data describing type and quality of the following:
 - 1. Plastic laminate (face grade and liner grade).
 - 2. Cabinet hardware (each type).
 - 3. Homogeneous solid surface material for window stools.
 - E. Certification that fire-retardant treatment materials comply with governing ordinances and meet or exceed ASTM E84 tests. Include certification by treating plant that treatment will not bleed through finish surfaces. Materials shall bear UL label showing Flame Spread 25 or less and smoke developed 40 or less. Mill certification is not acceptable.
 - F. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- 1.4 DELIVERY, HANDLING, STORAGE
- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, spoilage, and deterioration.
 - B. Do not deliver woodwork until painting, wet work, grinding, and similar operations have been completed in installation areas.
 - C. Store woodwork indoors in ventilated areas with constant but minimum temperature of 60 degrees F and maximum relative humidity of 55%.
 - 1. Comply with provisions of Section 01-6600.
- 1.5 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
 - B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise noted.
- B. Quality Standard: AWI Section 400 and Division 400B "Laminate Clad Cabinets".
 - 1. Grade: Custom.
- C. Type of Cabinet Construction: Flush Overlay.
- D. Softwood Lumber: PS20; graded in accordance with AWI; size and profiles as shown on drawings; maximum moisture content of 6 percent.
 - 1. Use for cabinet frame and concealed components.
 - 2. Species: Contractor's option.

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- E. Softwood Plywood: Doc PSI
 - 1. Use: At cabinet base, type 1 glue, no voids, B-B face veneer, species Contractor's option.

- F. Laminate Cladding: High-pressure decorative type NEMA LD3, manufactured by Formica, Wilsonart, Westinghouse. GP-28 (.028" thick).
 - 1. Colors: As indicated on Finish Schedule.
 - 2. Use: Horizontal surfaces other than tops, vertical surfaces, interiors of open cabinets except as noted otherwise on drawings.

- G. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium density fiberboard complying with ANSI A208.2, Grade MD with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1. Use: Cabinet interiors behind doors and drawers, interiors of all open cabinets, underside of wall cabinets, semi-exposed surfaces, shelves inside cabinets.

- H. Countertops:
 - 1. Type of Top: High Pressure Decorative Laminate: LEMA LD3 and GP-50(.050" thick).
 - a. Quality Standard: AWI Section 400C.
 - b. Colors: As indicated on Finish Drawings
 - c. Locations: As indicated on Finish Drawings
 - 2. Type of Top: Chemical resistant high pressure decorative laminates NEMA LD3, Grade HGP, GP-50, Test Procedure 3.9.5.
 - a. Colors: As indicated on "Finish Schedule".
 - b. Location: As indicated on Finish Drawings
 - 3. Type of Top: Homogeneous solid sheet material of filled plastic resin complying with materials and performance requirements in ANSI Z124.3 for type 5 or type 6, without a precoated finish.
 - a. Color/Pattern: As indicated on Finish Drawings.
 - b. Sizes: ½" thick. 1/8" radius
 - c. Joint Adhesive: As made especially for joining solid material surfaces, in appropriate color.
 - d. Caulk: Silicone sealant, in colors as furnished by manufacturer

- I. Edgebanding: 1mm or 3mm Extruded PVC
 - 1. Color and Grain: Match adjacent plastic laminate.
 - 2. Uses: Edges of doors and drawers.

- J. Caulk: As specified in Section 07-9200 for following locations:
 - 1. At backsplash and wall.
 - 2. Between backsplash and countertop.
 - 3. Around fixtures recessed into countertop.
 - 4. Base cabinets to wall.
 - 5. Wall cabinets to wall.
 - 6. In toe spaces where base of cabinet intersects with base.
 - 7. Countertops to base cabinets.
 - 8. Elsewhere as indicated on drawings.

- K. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

- L. Adhesive for Bonding Edges: As recommended by edgebanding manufacturer.

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2.2 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. General: Provide cabinet hardware and accessory materials for cabinets as indicated. Hardware items not shown but required for function indicated shall be furnished in the same finish and quality. Hardware shall comply with ADA, BHMA A156.9.
- B. Cabinet hardware including shelf supports, pulls, hinges, drawer slides and accessory materials. All hardware for Protective Environment rooms to minimize ability to wrap objects around them and be installed with tamper-proof screws.
 - 8. Pulls:
 - a. Wire pulls, 4-inches long, back mounted, dull chrome 38B, 26D.
 - b. Recessed cup
 - c. Locations: As indicated on drawings.
 - 2. Shelf Supports: Pre-drilled holes with adjustable metal or metal reinforced plastic clips.
 - 3. Drawer Slides: BHMA A156.9, BO4013
 - a. Shallow drawers (6" deep maximum): rated 100 lbs., side mounting, full extension.
 - b. Heavy Duty Drawers: Rated 100 lbs., side mounting, full extension.
 - 4. Hinges:
 - a. For Cabinets Doors: 100 degree, all metal nickel plated without spring.
 - 5. Door Silencers for Wood Doors with Recessed Hinges: BHMA A156.16, L03011.
 - 6. Locks: Cabinet Lock, BHMA A156.11, EO704.1.
 - 7. Keyboard Tray Shelves Drawer Slides: BHMA A156.9., Grade 1HD-100.
 - 8. Rails for Hanging Files: Provide body mounted molded rails for legal or letter size. Cutting or machining of drawer body/face not allowed.
 - a. Provide 16" wide cabinet for letter size; 19" wide for legal size.
 - 9. Pencil Drawers: Plastic
 - a. Color: Gray.
 - b. Size: 21-1/8" x 16-1/4" x 1-1/2" deep.
 - 10. Closet Rod and Flanges
 - 11. Provide additional hardware as required to complete details shown on drawings. Submit product data on additional hardware proposed for review during submittals,

2.3 WINDOW STOOLS

- A. General: Homogeneous solid sheet window stools cut to width required from sheet products.
 - 1. Color/Pattern: As shown on drawings
 - 2. Thickness: 1/2"
 - 3. Edges: Top edge 1/8" radius.
 - 4. Joint Adhesive: Especially manufactured for joining sheets, in color to match adjoining material.
 - 5. Caulk: Silicone sealant, in colors as manufactured for use with solid surface material.
 - 6. Available Products:
 - a. Corian; DuPont Polymers
 - b. Swanstone; Swan Corporation
 - c. Gibraltar; Wilsonart International

2.4 FASTENERS AND ANCHORS

- A. Screws: Comply with FS FF-S-111D.
 - 1. For metal framing supports, provide screws recommended by metal framing manufacturer.
- B. Nails: Comply with FS FF-N-105B.

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- C. Anchors: Nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Use stainless steel anchors for anchoring to treated wood.

2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated.
- D. Complete fabrication, including assembly, finishing, and hardware application to maximum extent possible, before shipment to project site. Disassembly components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition architectural woodwork to average prevailing humidity conditions before installing.
- B. Deliver inserts and anchoring devices to be built into substrate well in advance of time substrates are to be built.
- C. Before installing woodwork, examine shop-fabricated work for completion and back priming.
- D. Factory-cut openings to extent possible to receive hardware, electrical work, and similar items.

3.2 INSTALLATION

- A. Comply with AWI Section 1700.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level. Comply with approved shop drawings and AWI recommendations.
- C. Scribe and cut millwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts. Do not use additional overlay trim for this purpose.
- D. Install cabinet hardware to ensure smooth and correct operation.
- E. Install countertops level and secure. Make joints flush and hairline.
 - 1. For countertops over knee spaces exceeding 36 inches in width, install specified metal brackets.

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- F. Install homogeneous solid surface material window stools level and secure in accordance with manufacturer's instructions.
 - 1. Joints shall be formed using manufacturer's tinted adhesive to achieve a smooth inconspicuous joint.
 - 2. Joints at dissimilar materials shall be caulked with silicone sealant.

- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joint

- H. Anchorage: Secure finish woodwork to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed nailings, countersunk and filled flush with finished surface. Use hot-dipped galvanized nails for attaching finish work to treated grounds. For anchorage of aluminum support brackets to wall use 1/4" aluminum screws or toggle bolts of sufficient length to provide a secure and sturdy installation. Fasten to underside counter with screws.

- I. Handle, store and install fire-retardant millwork items in accordance with manufacturer's instructions and as required to meet classification or rating.

- J. Chipped, scratched or patched plastic laminate will not be accepted and must be replaced.

3.3 **ADJUSTMENT AND CLEANING**

- A. Repair damaged and defective millwork to eliminate defects functionally and visually; where not possible to repair, replace millwork. Adjust joinery for uniform appearance.

- B. Clean, lubricate, and adjust hardware.

- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finish to restore damaged or soiled area.

3.4 **PROTECTION**

- A. Protect cabinets and other woodwork items during remainder of construction period, in a manner acceptable to manufacturer and Installer.

END OF SECTION

SECTION 07-1113
BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Waterborne emulsified asphalt dampproofing for applications to gypsum sheathing behind Fiber Cement Siding.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Dampproofing system shall consist of materials and components from a manufacturer with a "single-source" responsibility and warranty and able to demonstrate at least five years of successful experience.
- B. Installer: Bituminous dampproofing work shall be performed by a firm certified in writing by the dampproofing manufacturer.
 - 1. The firm shall specialize in this type of work and be able to demonstrate at least three years of successful experience in this type of dampproofing work.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Manufacturer's Product Data: Clearly describing the quality of all materials and recommendations for application.
- C. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels.
 - 1. Comply with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.

1.5 JOB MOCK-UP

- A. Mock-Up Panel: Before work of this Section is started, provide exterior mock-up for Owner and Architect review and approval of all exterior finish elements materials and construction manner. Comply with provisions of Section 01-3323.

1.6 PRE-INSTALLATION CONFERENCE

- B. Prior to starting roofing and exterior envelope work, the General Contractor shall set up a meeting to comply with provisions of Section 01-3119 for the "Envelope and Roofing Pre-Installation Conference".

PART 2 - PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

- A. Provide products manufactured by Sonneborn a BASF company, www.buildingsystems.basf.com or approved substitute
 - 1. Substitutions: Products by the following manufacturers are acceptable:
 - a. W. R. Grace, www.grace.com
 - b. Koppers, www.koppers.com

- A. Type: Sonneborn's "HYDROCIDE 700" emulsified asphalt dampproofing for application by trowel, ASTM D1227, Type 2, Class, and ASTM D 1187, Type 1, complete with sealing mastic of type recommended by dampproofing manufacturer.
 - 1. Dampproofing materials and application methods shall comply with local and governing VOC requirements.
 - 2. For use on flashing trim.

- A. Type: Sonneborn's "HYDROCIDE 700B" emulsified asphalt dampproofing for application by brush, roller or spray, ASTM D1227, Type 2, Class, and ASTM D 1187, Type 1, complete with sealing mastic of type recommended by dampproofing manufacturer.
 - 1. Dampproofing materials and application methods shall comply with local and governing VOC requirements.
 - 2. For use on gypsum sheathing

PART 3 - EXECUTION

3.1 APPLICATION

- A. Preparation:
 - 1. Prepare surfaces scheduled for dampproofing in accordance with dampproofing manufacturer's instructions.
 - 2. Surfaces shall be firm, dry and free from frost, loose particles, cracks, pits, rough projections, grease, oil and other foreign matter detrimental to adhesion and monolithic application of dampproofing.
 - 3. Do not perform dampproofing work during temperature is 40 degrees and below.
 - 4. Protect from rain until coating has set.
 - 5. Do not allow material to freeze in containers.

- B. Applications to Exterior Sheathing:
 - 1. After preparing surfaces in accordance with manufacturer's instructions, apply dampproofing materials on exterior side of sheathing.
 - 2. Apply dampproofing material by brush, roller, or spray, without voids in two separate coats.
 - 3. Coverage per coat: Minimum 1 gallon per 30 to 35 square feet.
 - 4. Apply first coat and allow to become tacky before applying second coat.
 - 5. Within 12 hours apply second coat of semi-mastic and allow to set.
 - 6. Seal around all items projecting through walls with approved sealing mastic.
 - 7. Final application: 20 mils thick minimum and free of breaks and pin holes.

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- C. Applications to Flashing Trim:
 - 1. After preparing surfaces following manufacturer's instructions, apply dampproofing material to tops of flashing trim as shown on drawings.
 - 2. Apply dampproofing material by trowel without voids in 1 coat.
 - 3. Coat coverage: 1/16" wet film or 25 square feet per gallon.
 - 4. Final coat coverage: Free of breaks and pin holes.

3.2 CLEAN-UP

- A. After dampproofing work is completed, remove debris and scaffolds.
- B. Clean surfaces which are stained with dampproofing materials using a cleaner and method recommended by dampproofing manufacturer.
- C. Surfaces which are stained and cannot be cleaned shall be removed and replaced with new materials of same type and quality.
- D. Protect or cover product within seven days of application. Product should not be exposed to long-term UV.

END OF SECTION

SECTION 07-2107
THERMAL AND SOUND INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Batt and blanket type thermal insulation for installation in exterior studs.
- B. Foamed-in-place insulation:
 - 1. For areas around exterior opening in stud framed walls, within structural tube members and other cavities where indicated on drawings for thermal insulation.
- C. Spray-applied insulation
 - 1. Fibrous type thermal insulation for surface application to decking only where indicated on drawings.
- D. Rigid insulation behind fiber cement siding.
- E. Rigid Insulation at perimeter of concrete floor slabs.

1.2 QUALITY ASSURANCE

- A. Manufacturer: A firm with not less than five years experience in producing insulation similar to that specified and with sufficient production capacity to produce required product without causing.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals for each type of insulation and accessory specified.
 - 1. Manufacturer's Product Data: Indicating full compliance with requirements of this Section; clearly describing insulation performance and installation recommendations.
 - a. For surface applied sprayed insulation include instructions for proper repairs of installed product.
 - 2. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals
 - 1. Warranty: Manufacturers standard 15 year thermal warranty from date of Substantial Completion.

1.4 DELIVERY, HANDLING, STORAGE

- A. Insulation shall be delivered in original unopened packages bearing manufacturer's labels.
 - 1. Labels shall indicate R-Value, installation instructions and other descriptive data confirming compliance with specifications.
 - 2. Comply with Section 01-6500.
- B. Store and protect insulation in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Shield insulation from sunlight when stored outdoors for extended periods
 - 2. Maintain temperature and humidity within ranges required by manufacturer's

instructions.

1.5 DELIVERY, HANDLING, STORAGE

- A. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers and substitution as indicated for each type of insulation.

2.2 BATT/BLANKET INSULATION

- A. Product: Thermal Batt "Fiberglas" manufactured by Owens Corning, www.owenscorning.com
 - 1. Substitutions: Products of the following manufacturers and other manufacturers are acceptable:
 - a. CertainTEED Corporation
 - b. Georgia-Pacific Corporation
 - 2. Follow Section 01-2513 to submit substitution requests.
- B. Type (ASTM C665, Type I): Unfaced Thermal Batt/Blanket Insulation, commercial quality
 - 1. Combustibility (ASTM E136): Noncombustible
 - 2. Burning Characteristics: Flame Spread 25, Smoke Development 50.
 - 3. Thickness: 6-1/4.
 - 4. Thermal Resistance Value: R-19
 - 5. Width: To match stud spacing
- C. Locations: At metal stud exterior wall unless noted otherwise and as indicated on drawings.

2.3 RIGID BOARD INSULATION

- A. Product: Foamular CW 25 manufactured by Owens Corning, www.owenscorning.com
 - 1. Substitutions: Products of the following manufacturers and other manufacturers are acceptable subject to requirements of this Section.
 - a. Styrofoam products by Dow Chemical Company, www.dow.com
 - b. Diversifoam Products, www.diversifoam.com
 - 2. Follow Section 01-2513 to submit substitution requests.
- B. Type (ASTM C578): Extruded polyurethane, closed cell, rigid foam, with integrated continuous skins on front and back surfaces.
 - 1. Surface Burning Characteristic (ASTM E84): Flame-spread of 5 and smoke developed between 45 and 175.
 - 2. Thermal Resistance Value (ASTM C518) (hr x ft² x F^o/BTU):
 - a. Mean temperature 75°F: R-5.0/inch minimum
 - b. Mean temperature 40°F: R-5 per inch minimum
 - 3. Compressive Strength (ASTM D1621): 25 lb/in², min.
 - 4. Thickness as indicated on drawings.

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- C. Fasteners: Subject to compliance with requirements, provide one of the following:
 - 1. Adhesively Attached, Spindle-Type Anchors:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Eckel Industries of Canada Limited; Stic-Klip Type N Fasteners.
 - c. Gemco; Spindle Type.
 - 2. Anchor Adhesive:
 - a. AGM Industries, Inc.; TACTOO Adhesive.
 - b. Eckel Industries of Canada Limited; Stic-Klip Type S Adhesive.
 - c. Gemco: Tuff Bond Hanger Adhesive.
- D. Locations: Exterior walls behind cement fiber board siding and at perimeter of concrete floor slabs.

2.4 **SPRAY FOAM INSULATION FOR METAL STUDS**

- A. Type: 2 Part Quick-Cure
 - 1. Expands with approximately 8 to 1 ratio
 - 2. Fully expands within seconds, fully cures within hours
 - 3. System Density: Standard 1.75
 - 4. R-Factor Aged: 6-7 per inch.
- B. Locations: For cavity not accessible for batt insulation on exterior walls and as indicated on drawings.

2.5 **SPRAYED THERMAL AND SOUND CONTROL INSULATION (SURFACE APPLIED)**

- A. Type: Surface, spray applied, cellulose, thermal insulation, 100% asbestos-free.
 - 1. Bond strength, (ASTM E-736; field tested after 5 years): 400 psf.
 - 2. Surface Burning (ASTM E-84): Flame Spread - 5; Smoke Developed - 5.
 - 3. R Value: As indicated on drawings.
 - 4. STC Rating: 45 minimum
 - 5. Thickness: As indicated on drawings (Ranging from 3 to 19)
 - 6. Color: To be selected by Architect from manufacturers standard options.
- B. Location: In crawl space as indicated on Drawings.

PART 3 - EXECUTION

3.1 **GENERAL**

- A. Install each type of insulation in accordance with manufacturer's published recommendations and without visible gaps or segregation.

3.2 **BATT INSULATION INSTALLATION**

- A. Batt Insulation In Walls:
 - 1. Do not install insulation before mechanical and electrical work is complete.
 - 2. "Friction-fit" insulation between studs until wall cavities are completely filled, and without gaps and voids.
 - 3. Fit insulation tightly to mechanical and electrical items within the area of insulation.
 - 4. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating insulation with tape of type recommended by manufacturer.
 - 5. For metal studs in exterior walls without a back cover and with heights over 8 feet,

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secure insulation in place with wire strands with first wire placed horizontally at 8 feet above floor, then spaced horizontally 2 feet apart. Stretch and tie wire strands at every fourth stud.

3.3 RIGID BOARD INSULATION INSTALLATION

- A. Verify that walls are dry, flat and free of fins and other materials that may prevent proper adhesion and insulating quality of insulation board.
- B. Neatly cut and shape insulation boards to fit around wall penetrations.
 - 1. Seal around cut-outs with approved adhesive.
 - 2. Boards shall be tightly fitted to each other.
- C. Install board insulation on concrete, concrete masonry unit substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete and CMU substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. Install board insulation within cavity walls adhesively and to coordinate with installation of masonry ties

3.4 INSTALLATION OF FOAM INSULATION

- A. General: Install foam insulation following manufacturer's instructions.
- B. Install foam insulation in CMU cores using pressure fill method to a uniform density. Completely fill all spaces, crevices and voids.

3.5 SPRAYED IN INSULATION INSTALLATION

- A. Preparation:
 - 1. Prepare surfaces to receive sprayed sound control insulation in accordance with manufacturer's recommendations.
 - 2. Provide ventilation in areas to receive sprayed insulation during and 24 hours after application, to properly dry material and maintain nontoxic, unpolluted safe working area.
- B. Inspection: Verify that:
 - 1. Surfaces are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt or other foreign substances which may impair proper bonding of insulation.
 - 2. Objects which will penetrate insulation, such as clips, hangers, support sleeves and similar items are securely attached to substrates.
 - 3. Ducts, piping, equipment and other suspended construction that could interfere with application of insulation not positioned until work is complete.
- C. Installation
 - 1. Beginning of insulation work means installer accepts existing conditions.
 - 2. Comply with sprayed insulation manufacturer's instructions for mixing materials and application procedures to achieve R ratings indicated.
 - 3. Extend insulation full thickness over entire area of each substrate to be protected. Unless otherwise recommended by manufacturer, install insulation covering in a single course.

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- D. Field Quality Control: Contractor shall employ and pay a qualified independent testing laboratory to perform field quality control testing.
 - 1. Contractor and testing laboratory shall comply with requirements of Section 01332.
 - 2. Within each area, randomly select a typical bay, and test for thickness and density per ASTM E-605.
 - 3. Testing Laboratory shall report test results promptly and in writing to Contractor and Architect.
 - 4. Repair or replace sprayed insulation where test results indicate sprayed insulation does not comply with requirements. Provide further inspection to verify compliance with requirements, at no additional cost.

3.6 CLEANING, REPAIR, AND PROTECTION

- A. After completion of spraying and foaming operations remove over-spray and fall-out of materials from surfaces not specifically required to be insulated and clean to remove soiling.
- B. Cure exposed sprayed insulation in compliance with manufacturer's recommendations to prevent premature drying.
- C. Protect installed insulation from damage.
- D. Repair or replace work which has not been successfully protected at no additional cost to Owner.

3.7 PROTECTION

- A. Protect the installed insulation from physical abuse and the weather.
- B. Replace insulation which is damaged or becomes wet after installation.

END OF SECTION

SECTION 07-4113
METAL ROOF PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Prefinished standing seam steel roof and fascia, panels for installation over solid decking complete with related flashing, miscellaneous trim, snow retention systems, closures, drip flashing, fastening devices, and other accessory components and prefinished "brakemetal" work required to complete the metal roof work.
- B. All sealant work required to waterproof the metal roof system is the work of this Section.
- C. Coordinate with wood decking specified in Section 06-1000.

1.2 QUALITY ASSURANCE

- A. Manufacturer: The work of this Section shall consist of materials and components for a watertight installation and be performed by a firm with a "Single-Source" responsibility and warranty and able to demonstrate a minimum of five years successful experience.
- B. Installer: Shall be approved in writing by roofing materials manufacturer and able to demonstrate three years successful experience in this type roofing system.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Clearly indicate:
 - a. Material descriptions.
 - b. Methods of attachment of metal panels and snow guards.
 - c. Types of flashing and trim.
 - d. All other pertinent details required for secure and complete installation of roof panels.
 - e. Type and color of sealant.
 - 2. Manufacturer's Product Data: Clearly describing the quality of panels and components including type, quality and performance of coating finish.
 - 3. Submit calculations with registered engineers seal, verifying roof panel and attachment method resists windpressures imposed on it pursuant to applicable building codes.
 - 4. Selection Samples:
 - a. Minimum 2" x 2" size representing available manufacturer's standard colors.
 - b. One sample of snow retention system
 - 5. Performance Tests: Submit results indicating compliance with minimum requirements of the following:
 - a. Air Infiltration: ASTM E283.
 - b. Water Infiltration: ASTM E331.
 - c. Wind Uplift: U. L. 90.
 - 6. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals

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1. Warranty: Guarantee covering watertightness of the roofing system for the period of two years from the date of Substantial Completion.
2. Warranty: Certification that finish conforms to all tests for adhesion, flexibility, and longevity as specified by Kynar 500 finish supplier.

1.4 DELIVERY, HANDLING, STORAGE

1. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels. Comply with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
 1. Protect products against damage by construction traffic.
 2. Store panels in dry place to avoid condensation and avoid contact with materials which may cause staining, such as lime, cement, fresh concrete and chemicals.

1.5 WARRANTY

- A. Provide warranties for the following:
 1. Paint finish: twenty year guarantee against cracking, peeling and fade (not to exceed 5 N.B.S. units).
- B. Applicator shall furnish guarantee covering watertightness of the roofing system for the period of two (2) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 METAL ROOF PANELS

- A. Panel Type: Berridge "TEE-PANEL" Metal Standing-Seam panels, continuous, roll-formed of hot-dipped prefinished galvanized steel ASTM A446 complete with extruded vinyl weather seal as integral part of snap-on seam, as manufactured by Berridge Manufacturing Company/Houston, Texas.
 1. Panel Gage & Width: 24 gage, 17-3/4" on center seam spacing, 1" seam height.
 2. Pre-Finish G90 Galvanized Steel: Kynar 500.
 3. Color: To be selected by Architect from manufacturer's Energy Star compliant options.
 4. UL Label: Underwriters Laboratory Label UL90, and applicable fire ratings indicated on drawings.

2.2 ACCESSORY COMPONENTS:

- A. Flashing: Miscellaneous flashing components required to make the metal roof panels watertight. Finish to match panels.
- B. Anchors and Fasteners: Stainless Steel; concealed type, with washers as required, spaced as required to meet uplift loads.
- C. Water Shield: Carlisle QSC-707 roofing underlayment, self-adhering sheet membrane ASTM D1970. Use for low slopes as ice and water shield.
- D. Gutters/Downspouts: Shop fabricated type as specified in Section 07-6207.

- E. Snow Retention Systems
 - 1. Product: SNO-BAR manufactured by Action Manufacturing, www.sno-bar.com
 - 2. Type: Snow retention system that clamps directly to the standing seams without penetrating the roof system`
 - a. Clamps: 12 Gauge one-piece stainless steel clamps with stainless steel set screws used at every roof seam
 - b. Bars: gauge Stainless Steel
 - c. Accessories: Stainless steel set screws, TEK screws and end caps as recommended by SNO-BAR manufacturer.
 - d. Finish: stainless steel, mill finish
- F. Sealant: Exterior quality of type specified in Section 07-9200. Sealant exposed to view shall be a color which matches the color of panels.
- G. Substitutions: Products of the following manufacturers are acceptable. Products of other manufacturers may be submitted for review in accordance with Section 01-2513.
 - 1. Dimensional Metals, Inc.
 - 2. IMETCO
 - 3. Zip Rib, Merchant and Evans, Inc.
 - 4. Metal Sales Manufacturing Corporation
 - 5. AEP Span

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate to ensure proper attachment to framing.
- B. Inspect roof deck to verify deck is clean and smooth, free of depressions (level to 1/4" in 20'), waves or projections, properly sloped to valleys or eaves as applicable.
- C. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- D. Verify roofing underlayment, has been installed over solid sheathing and fastened in place.
- E. Ensure felt installed horizontally, starting at eave to ridge with a 6" minimum overlap.
- F. Ensure that all nail heads are totally flush with the substrate.

3.2 INSTALLATION

- A. Install metal panels in accordance with approved shop drawings and panel manufacturer's published recommendations to achieve a watertight installation.
- B. Do not allow panels or trim to come into contact with dissimilar materials.
- C. Set metal panels true to line, without warp or rack.
- D. Install sealants as noted on shop drawings and to achieve a watertight installation.
- E. Install ice and water shield under metal roof panels for low roof slope installations.

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- F. Completed installation shall be free of rattles, noise due to thermal movement, and wind whistles.
- G. Upon completion of the metal roof work, remove strippable plastic film from all prefinished metal in accordance with manufacturer's instructions.
- H. Install snow retention system using clamps and according to manufacturer's instructions. Space components as recommended by manufacturer.
- I. Touch up mars, scratches and cut edges exposed to view with type of touch-up coating recommended by manufacturer to match finish.
- J. Remove and replace panels or components which are damaged beyond repair.

3.3 PROTECTION

- A. Do not allow traffic on completed roof. If required, provide cushioned walkways.
- B. Protect installed roof panels, trim and accessories from damage caused by adjacent construction until completion of installation.

3.4 CLEANING

- A. Clean any grease, finger marks or stains from the panels, trim, and accessories as recommended by manufacturer.
- B. Remove scrap and debris from the site.

END OF SECTION

SECTION 07-4646
FIBER CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide the following fiber cement products for exterior applications:
 - 1. Siding
 - 2. Panels
 - 3. Trim
 - 4. Soffit Vents

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish.
- C. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

1.4 JOB MOCK-UP

- A. Mock-Up Panel: Before work of this section is started, provide exterior mock-up for Owner and Architect review and approval of all exterior finish elements materials and construction manner. Comply with provisions of Section 01-3323.

1.5 WARRANTIES

- A. Manufacturer's standard form in which siding manufacturer agrees to repair or replace siding or paint finish that fails in materials or workmanship within 50 years.
- B. Failures include, but are not limited to, cracking, deforming, fading, or otherwise deteriorating beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. CertainTeed Corporation, Siding Products Group, P.O. Box 860, Valley Forge, Pennsylvania 19482. ASD. Tel: (800) 233-8990 (professional) or (800) 782-8777 (consumer). www.certainteed.com.

- B. Substitutions: Products of the following are acceptable. Products of other manufacturers may be submitted for review in accordance with Section 01-2513.
1. GAF Materials Corporation
 2. James Hardie

2.2 PANELS

- A. Fiber Cement Board Panels - General: CertainTeed Fiber Cement Board Panels consist of cement, fly ash, silica and cellulose fiber formed under high pressure into boards with integral surface texture; complying with ASTM C 1186 Type A Grade II; machined edges; for nail attachment.
- a. Surface Burning Characteristics: Flame spread index of 0, smoke developed index of 0, maximum; when tested in accordance with ASTM E 84.
 - b. Combustibility: Noncombustible, when tested in accordance with ASTM E 136, ULC S135 and ULC S114.
 - c. Flexural Strength: At least 1450 psi (10 MPa) when in equilibrium condition, and at least 1015 psi (7 MPa) when in wet condition, tested in accordance with ASTM C 1185.
 - d. Freeze Thaw Resistance: At least 80 percent flexural strength retained, when tested in accordance with ASTM C 1185.
 - e. Water Tightness: No water droplets on underside, when tested in accordance with ASTM C 1185.
- B. Horizontal Siding: CertainTeed WeatherBoards Lap Siding.
- a. Thickness: 5/16 inch (7.9 mm), plus or minus .04 inch (1 mm).
 - b. Length: 12 feet (3657 mm), plus 0, minus 1/8 inch (3 mm).
 - c. Style: Cedar lap siding.
Width: 5-1/4 inches (133 mm) wide.
Width: 8-1/4 inches (210 mm) wide. Sealant/Primer: FiberTect Sealant/Primer.
 - d. Field Finish Paint: 100 percent acrylic latex as specified in Section 09900.
- C. Vertical Siding Panels: CertainTeed WeatherBoards Vertical Siding Panels.
- a. Thickness: 5/16 inch (7.9 mm), plus or minus .04 inch (1 mm).
 - b. Size: 48 by 96 inches (1220 by 2440 mm).
 - c. Style: Stucco texture panel.
 - d. Sealant/Primer: FiberTect Sealant/Primer.
 - e. Field Finish Paint: 100 percent acrylic latex as specified in Section 09-9100.
- D. Soffit: CertainTeed WeatherBoards Soffit, ventilated.
- a. Thickness: 1/4 inch (6.35 mm), plus or minus 1/32 inch (0.8 mm).
 - b. Style: Smooth texture, 12 inches (305 mm) wide.
 - c. Ventilated soffit.
 - d. Sealant/Primer: FiberTect Sealant/Primer.
 - e. Field Finish Paint: 100 percent acrylic latex as specified in Section 09-9100.
- E. Soffit Panel: CertainTeed FiberCement Soffit Panel.
- a. Thickness: 1/4 inch (6 mm), (6.35 mm, plus or minus 0.8 mm).
 - b. Width: 48 inches (1220 mm).
 - c. Length: 8 feet (2440 mm), plus 0, minus 1/8 inch (3.17 mm).
 - d. Style: Smooth panel.
 - e. Sealant/Primer: FiberTect Sealant/Primer.
 - f. Field Finish Paint: 100 percent acrylic latex as specified in Section 09-9100.
- F. Trim: CertainTeed WeatherBoards Trim

- a. Size:
 - 1. Thickness 3/4 inch (19 mm) plus or minus (1mm)
 - 2. Width:
 - 1. 3-1/2 inch (89 mm).
 - 2. 5-1/2 inch (140 mm).
 - 3. 9-1/4 inch (235 mm).
 - 4. 11-1/4 inch (286 mm).
 - 3. Length: 12 feet (3.657 m) plus or minus 1/8 inch (3.17 mm).
- b. Sealant/Primer: FiberTect Sealant/Primer.

2.3 ACCESSORIES

- A. Sealant: Paintable, 100 percent acrylic latex caulk complying with ASTM C 920.
- B. Flashing: Coordinate with Section 07-6507.
- C. Nails: Length as required to penetrate minimum 1-1/4 inch (32mm) into solid backing; hot-dipped galvanized or stainless steel.
- D. Water resistive barrier: Coordinate with Section 07-1113.
- E. Field Finish Paint: 100 percent acrylic latex as specified in Section 09-9100.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to commencing installation, verify governing dimensions of building and condition of substrate.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Examine, clean, and repair as necessary any substrate conditions that would be detrimental to proper installation.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and as indicated on drawings. Read warranty and comply with all terms necessary to maintain warranty coverage. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 - 1. Use trim details indicated on drawings.
 - 2. Touch up all field cut edges before installing.
 - 3. Pre-drill nail holes if necessary to prevent breakage.
- B. Prior to installation of siding and trim, install water resistive barrier and flashings as required by code to provide a weather resistant substrate.

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- C. Over Foam or Gypsum Based Sheathing: Read and comply with sheathing manufacturer's recommendations.
 - 1. For sheathing of 1 inch (25 mm) thickness or less, fasten through sheathing into studs using correspondingly longer fasteners.
- D. Allow space between ends of siding panels that butt against trim or dissimilar materials for thermal movement; seal joint between panel and trim with exterior grade sealant.
- E. Butt Joints in Horizontal Siding: Avoid butt joints in lap siding where possible; where joints are inevitable, stagger joints between successive courses. Follow manufacturer's installation instructions for treatment of butt joints.
- F. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- G. Furred Installation: Leave space at top and bottom open; top may be behind soffit; at bottom install insect screen over opening by wrapping a strip of screen over bottom ends of vertical furring strips.
- H. Do not install siding less than 6 inches (150 mm) from surface of ground nor closer than 1 inch (25 mm) to roofs, patios, porches, and other surfaces where water may collect.
- I. After installation, seal joints in accordance with manufacturer's installation instructions. Seal around all penetrations. Paint all exposed cut edges.
- J. Finish Painting: Specified in Section 09-9100.
- K. Finish Painting: Within 24 months after installation, paint siding and trim with one coat primer and two coats finish paint.

3.4 CLEANING

- A. At completion of work, remove debris caused by siding installation from project site.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 07-5300
ELASTOMERIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Single-ply EPDM fully adhered roofing system over rigid insulation and gypsum roof panels (sheathing).
- B. Recovery board under membrane roofing.
- C. Prefabricated and shop-fabricated gravel guards, copings, wall and roof expansion joints.

1.2 QUALITY ASSURANCE

- A. Materials furnished and installed under this Section, including membrane, fasteners, adhesives, gravel guards, copings, and other roof related components, shall be manufactured or approved in writing by a firm specializing in membrane roofing and able to demonstrate a minimum of ten years successful experience and with a "Single-Source" responsibility and warranty.
 - 1. Materials and methods used shall be UL approved for the Design Assembly referenced on the Drawings.
 - 2. Roofing products including flashing shall be 2003 IBC, FBC 2004, and ASCE-7 compliant and constructed to resist 90 mph wind loads as required by governing codes.
 - 3. Prefabricated metal fascia's coping and scuppers shall be certified by the coping manufacturer to meet performance design criteria according to the ANSI/Spri ES-1 test standard.
 - 4. Roofing products and installation methods shall comply with current federal, state, and regional and local codes including VOC regulations.
- B. The installer shall be approved in writing by the roofing materials manufacturer and able to demonstrate a minimum of five years successful experience in similar work.
- C. There shall be no deviation from this specification and the approved shop drawings without prior written approval of the Architect and Roofing Manufacturer.
- D. Upon completion of the installation, an inspection shall be conducted by an authorized Technical Representative of Roofing Manufacturer to verify that the roofing system has been installed in accordance with Roofing Manufacturer's most current published specifications and details, and approved shop drawings.
- E. Comply with applicable seismic requirements for attachment to substrate.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.

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- B. Product Data: Include data substantiating that materials comply with requirements of this Section.
- C. Samples:
 - 1. Finished roofing sheets, including T-shaped side/end-lap seam.
 - 2. Fasteners, gravel guard, coping, and other roof components if requested by Architect.
- D. Qualification Letter: Shall clearly contain applicator's qualification and roofing manufacturer's approval as required under Quality Assurance in this Section.
- E. Certification Letter: Manufacturer shall certify in writing that roofing materials and installation methods comply with latest VOC regulations as required under Quality Assurance in this Section.
- F. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- G. Shop Drawings: Showing roof configuration, including layout of tapered insulation material, sheet layout, seam locations, colors (as applicable), details at perimeter, and special conditions such as expansion joints, and copings.
 - 1. Provide layouts at 1/4-inch scale and details at 3-inch scale.
- H. Reports: Pre-roofing conference and final roof inspection reports to Architect, Owner and Roofing Contractor.
- I. Warranty: Three copies of written warranty and supporting letter as required under Part 1.6 - Warranty.

1.4 DELIVERY, HANDLING, STORAGE

- A. Deliver roofing materials and accessories in manufacturer's unopened containers and containers, clearly marked with supplier's name, UL compliance, and installation instructions.
 - 1. Comply with Section 01-6500.
- B. Handle roofing materials and accessories to avoid damage to containers. Store as recommended by manufacturer, provide protection of incomplete roofing materials, from the weather.
 - 1. Comply with Section 01-6600.
- C. Store and protect sheet metal products in accordance with Section 01-6600.
 - 1. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and provide ventilation.
 - 2. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.5 WARRANTY

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- A. Provide written full system warranty, signed by the manufacturer of primary roofing materials, agreeing to replace/repair defective materials and workmanship, including any leakage of water, abnormal aging or deterioration of materials, and other failures of sheet roofing, adhesives, flashings, gravel guards, and copings and other work installed under this contract, to perform as required within warranty period. Repairs and replacements required because of acts of God and other events beyond Contractor/Installer/ Manufacturer's control (and which exceeds performance requirements) shall be completed under the directions of the manufacturer and paid for by the Owner at prevailing rates.
 - 1. Warranty period is fifteen (15) years after date of substantial completion for repair of leaks and twenty (20) years material warranty for deterioration of the membrane.

- B. Roofing manufacturer's warranty department shall furnish to the Architect, Contractor, and Owner, a letter that states:
 - 1. All contract documents relating to the roof system have been reviewed.
 - 2. All materials are physically and chemically compatible with each other, and the system, as designed, is suitable for the specified warranty.

1.6 JOB CONDITIONS

- A. Pre-Roofing Conference:
 - 1. Prior to starting roofing and associated work, set up a job-site meeting with the following in attendance:
 - a. Architect.
 - b. Owner's Representative.
 - c. Roofing Contractor.
 - d. Roofing Materials Manufacturer's Representative.
 - e. Trades related to roofing work such as plumbing and mechanical.

- B. Reporting Design Defects: The Contractor shall report to the Architect any defects in design which, in his opinion, may develop leaks, and shall be responsible for all roofing work, including flashing, drain gasketing, and sheet metal work, and other work necessary to produce a watertight system.

- C. Recording: The Contractor shall record discussions of conference and decision reached, and furnish copy of record to each attendee. Review foreseeable methods and procedures related to roofing work, including but not necessarily limited to the following:
 - 1. Review roofing system requirements (drawings, specifications and other contract documents).
 - 2. Review required submittals, both completed and yet to be completed.
 - 3. Review status of substrate work (as performed by others), including drying, structural loading limitations and similar considerations.
 - 4. Review availability of materials, tradesmen, equipment and facilities.
 - 5. Review required inspection, testing, certifying and materials usage, accounting procedures.
 - 6. Review procedures for protection of roofing during remainder of construction period.

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- D. Work Organization: The Contractor shall plan and schedule progression of the work so that finished areas do not have to be walked over or otherwise used as routes for material transportation. Provide adequate protection for the new membrane on all such routes. The Contractor shall plan and administer all work by other trades associated with the roof. If trades cannot be scheduled to prevent their working over the completed roof an alternative (i.e. a temporary roof) must be approved and executed.
- E. When staging for or performing any new or existing roofing work the Contractor shall handle, store, and place adhesives, solvents and other hazardous fume materials so as to avoid any interaction with HVAC systems air intakes. Throughout the duration of the project the Contractor shall coordinate all roofing work with the Director of Facilities prior to starting and if necessary to schedule temporary closing of HVAC intake(s) to avoid hazardous fumes from infiltrating the building.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Manufacturer

- 1. Provide products manufactured by Carlisle, www.carlisesyntec.com
- 2. Substitutions: Products by the following manufacturers are acceptable:
 - a. Firestone Roofing, www.firestonebpc.com
 - b. GAF Roofing, www.gaf.com

General: Roofing system for the work of this Section shall be single-ply adhered system, with all materials and components, including copings, flashings, sealants, required for complete and watertight installations to meet project requirements and conditions.

- 1. All materials and accessories used with this roofing system must be of types and quality approved by Roofing Manufacturer.

2.2 ROOFING MEMBRANE

A. Membrane: Carlisle Sure-Seal Non-Reinforced Membrane, Black, FleeceBACK 115 .060 inch thick non-reinforced EPDM laminated to .055 inch thick non-woven polyester fleece-backing with the following physical properties:

- 1. Tolerance on Nominal Thickness: ASTM D751, +/- 10%.
- 2. Thickness Over Fleece, Minimum, Inch (mm): Optical Method, .030 (.762).
- 3. Breaking Strength, Minimum, lbf (N): ASTM D751, Grab Method, 90 (400).
- 4. Elongation, Ultimate, Minimum, Percent: ASTM D412, 300.
- 5. Tearing Strength, Minimum, lbf (N): ASTM D751, B Tongue Tear, 10 (45).
- 6. Brittleness Point, Maximum, Zero Ozone Resistance: No cracks, ASTM °F (°C): ASTM D2137, -49 (-45).
- 7. Resistance to Heat Aging: ASTM D573
- 8. Ozone Resistance: ASTM D471, no cracks
- 9. Resistance to Water Absorption: ASTM D471., 4.0
- 10. Resistance to Outdoor (UV) Weathering: ASTM G26, no cracks, no crazing

B. Adhesives: Carlisle's FAST 100.

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- C. In-Seam Sealants, Splicing Cements, Cut-Off Mastics: As recommended and manufactured by Carlisle SynTec Systems.

2.3 ROOFING MEMBRANE ACCESSORIES

- A. Deck to Wall and Deck to Deck Expansion Joints: Foamed EPDM expansion joint support by Carlisle.
- B. Flashing: Sure-Seal Pressure Sensitive 40 mil black, semi-cured EPDM.
- C. Adhesive, Tape, In-Seam Sealants, Splicing Cements, Cut-off Mastic, Cleaners: As recommended or manufactured by Carlisle SynTec Systems.
- D. Gravel Guard: SecurEdge, .050 inch thick aluminum. Submit to Architect for approval.
- E. Coping: SecurEdge, .050 inch thick aluminum, with 20 gage anchor cleat. To be selected by Architect from manufacturers standard options.
- F. Termination Bar: 1" wide and .098" thick extruded aluminum bar pre-punched 6" on center with a sealant ledge to support Lap Sealant.
- G. Molded Pipe Flashing: Sure-Seal EPDM molded pipe flashing.
- H. Parapet Vents: Aluminum 7 inch diameter opening, stationary wall vents No. DARC7, silver finish, as manufactured by Deflecto Corporation, Indianapolis, Indiana.
 - 1. Distributor: Dale Supply Company, Phone: (615) 244-3573.

2.4 PREFABRICATED/SHOP FABRICATED SHEET METAL

- A. Prefinished Aluminum Sheet: ASTM B209, alloy, temper, plain.
 - 1. Finish: Factory-applied Kynar 500, fluorocarbon coating.
 - 2. Color: As indicated on Elevation Drawings
 - 3. Gauges:
 - a. Coping: Widths to 16", .040" gauge.
 - b. Gravel Guard: .036" gauge.

2.5 SHEET METAL ACCESSORIES

- A. Fasteners: Same metal as flashing/sheet metal. Match finish of exposed heads with material being fastened. Type and size to suit application.
- B. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, free of sulfur, compounded for 15-mil dry thickness per coat.
- C. Sealant: Exterior quality conforming with Section 07-9200.
- D. Paper Slip Sheet: 5-lb. rosin-sized building paper. Use where stainless steel or aluminum is to be installed directly on cementitious or wood substrate.
- E. Polyethylene Underlayment: 4-mil minimum carbonated polyethylene film tested in accordance with ASTM E154.

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- F. Neoprene Washers: Required for all fasteners which will remain exposed to the weather.
- H. Metal Accessories: Sheet metal clips, continuous cleats, straps, anchoring devices, as required for installation of work, matching or compatible with adjoining materials, noncorrosive, size and gage required for performance.
 - 1. Continuous cleats shall be 22 gage galvanized metal, fastened 12" max. o.c., unless indicated otherwise.

2.6 ROOF INSULATION

- A. General: Roof Insulation shall not be produced with, or contain any of the United States EPA regulated CFC compounds listed in the Montreal Protocol of the United Nations Environmental Program.
- B. Polyisocyanurate Board: Closed cell foam core bonded on each side to fiber reinforced facers.
 - 1. Density (ASTM D162): 2.0 lbs/cu.ft.
 - 2. Thermal Resistance Value (ASTM C518): 38 average
 - 3. Compressive Resistance (ASTM D 1621): 20 psi
 - 4. Water Vapor Perm (ASTM E 96): Less than 1 perm
 - 5. Flame Spread (ASTM E 84): Less than 50
 - 6. Thickness: As shown on Drawings.
 - 7. Tapered: At cants, crickets, roof edges, saddles and as shown on drawings.
- C. Recovery Board: 1/2 inch thick extruded polystyrene board, as recommended by roofing membrane manufacturer.
- D. Gypsum Roofing Panels (Sheathing):
 - 1. Thickness: 1/2 inch.
 - 2. Weight: 1.95 lb/sq. ft.
 - 3. Surfacing: Fiberglass mat.
 - 4. Flexural Strength, Parallel (ASTM C473): 80 lbf, minimum.
 - 5. Flute Span (ASTM E661): 5 inches.
 - 6. Permeance (ASTM E96): Not more than 35 perms.
 - 7. R-Value (ASTM C518): Not less than 0.56.
 - 8. Water Absorption (ASTM C1177): Less than 10 percent of weight.

2.7 FASTENERS

- A. EPDM Membrane Strip: Russ fasteners, 6" wide EPDM, used with fastening plates.
- B. Sure-Seal Seam Fastening Plates: 2" diameter metal. Use stainless steel fasteners in treated wood.

2.8 ROOF WALKWAYS.

- A. Molded Rubber Walkway Pads: 1/2" thick x 30" x 30" by Carlisle SynTec System, black.

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2.8 FABRICATED METAL UNITS

- B. General: If not available as prefabricated units, shop-fabricate to comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual".
1. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to prevent leakage, damage, or deterioration of the work.
 2. Form work to fit substrates.
 3. Form exposed work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
 4. Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer.
 5. Protect metal from noncompatible metal or corrosive substrates by coating with bituminous coating as recommended by manufacturer/fabricator.
- C. Gravel Guards and Copings:
1. Form Section in maximum 10 foot or 12 foot lengths true to shape, accurate in size, square, and free of distortion and defects.
 2. Corner Pieces: Fabricate 18" x 18" units from one piece metal; solder for watertightness and rigidity.
 3. Vertical Surfaces: Fabricate with bottom edge formed outward 1/4 inch and hemmed to form a drip edge.
 4. Exposed Edges: Hem on underside 1/2 inch.
 5. Make allowances for expansion joints. Use intermeshing hooked flanges, not less than one inch deep, filled with mastic sealant.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection:
1. Before starting the work of this Section, verify other work affecting sheet metal work is complete and approved.
 2. Beginning of sheet metal work means acceptance of existing conditions.
- B. For Roofing Work:
1. Exercise care when working on or about roof surfaces to avoid damaging or puncturing membranes and flashings.
 2. Place plywood panels on roof surfaces adjacent to work of this Section and on access routes. Keep in place until completion of work.
- C. Install flashings and accessory items as shown, and as recommended by manufacturer.
- D. Install roof panels (sheathing) on metal deck following manufacturer installation instructions.

3.2 ROOF MEMBRANE INSTALLATION

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- A. Start installation in presence of manufacturer's technical representative.
 - 1. Cut out and repair membrane defects at end of each day's work.
- B. Install membrane by unrolling over prepared substrate, fastening at perimeter and at roofing penetrations. Lap adjoining sheets and bond, covering top edges of each sheet at seams with uniform fillet of sealant as recommended by manufacturer. Install flashings and counterflashings as shown and as recommended by manufacturer.
- C. Installs recovery board over rigid insulating concrete substrate as recommended by roofing manufacturer.
- C. Walkway Protection: Install walkway protection units at locations shown and where required for access to roof-mounted equipment.
 - 1. DO NOT allow membrane seams to fall under walkway pads.
- D. Special Membrane: Install mats where grease and oil (kitchen exhaust, similar locations) and other contaminants are prevalent. Adhere membrane to roof as recommended by manufacturer. Extend a minimum of ten feet out in all directions from discharge opening.
- E. Expansion Joints: Coordinate locations with existing structural expansion joints and changes in direction of framing; install type of expansion joint specified or as recommended by roofing manufacturer.

3.3 SHEET METAL INSTALLATION

- A. Perform sheet metal work in accordance with approved shop drawings and installation instructions and recommendations of SMACNA "Architectural Sheet Metal Manual."
 - 1. Anchor work securely in place by methods indicated, providing for thermal expansion; conceal fasteners where possible.
 - 2. Set units true to line and level.
 - 3. Install work with laps, joints, seams watertight and weatherproof.
- B. Underlayment: For stainless steel or aluminum to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper or a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install counterflashing in reglets, either by snap-in seal arrangements or by wedging in place for anchorage and filling reglet with mastic or elastomeric sealant.
- E. Flashing Attachment:
 - 1. Secure all flashing 16 inches on centers.
 - 2. Install parapet cap flashing and gravel guards with continuous hold-down clips secured 12" o.c. maximum.
 - 3. Exposed fasteners shall be complete with neoprene washers 16" o.c.
- F. Joints for Gravel Guards and Parapet Caps.
 - 1. Overlap or butt base metal as recommended by manufacturer.

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2. Set in solid bed of plastic cement.
3. Make allowances for expansion joints.
4. When field-soldering, wipe and wash soldered joints to remove traces of flux immediately after soldering.

3.4 PROTECTION OF ROOFING

- A. Upon completion of roofing, protect during remainder of construction period from damage or deterioration. Damaged roofing shall be repaired or replaced.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Protection: Protect flashings and sheet metal work during construction from damage or deterioration.

END OF SECTION

SHOP-FABRICATED SHEET METAL ACCESSORIES AND TRIM 07-6207-1

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SECTION 07-6207 SHOP-FABRICATED SHEET METAL ACCESSORIES AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Miscellaneous shop-fabricated sheet metal items as required to complete the work of this project, including the following:
 - 1. Counter flashing, and base flashing.
 - 2. Gutters and downspouts (rain drainage).
- B. Coordinate work of this section with Sections 07-5300 and 07-7100.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Product Data: Manufacturer's data sheet for factory-finished sheet metal and type of guarantee.
 - 2. Samples: 12-inch long samples of shop fabricated products with specified factory finish.
 - 3. Shop Drawings: Indicating layout, profiles, methods of joining, and anchorages details, including major counterflashings, trim/fascia units, gutters, conductor heads, downspouts, and scuppers.
 - a. Provide layouts at 1/4-inch scale and details at 3-inch scale.
 - 4. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.3 QUALITY ASSURANCE

- A. The work of this section shall be performed by a firm specializing in sheet metal work with a minimum of five years of successful experience.

1.4 JOB MOCK-UP

- A. Mock-Up Panel: Before work in this section is started, provide exterior mock-up for Owner and Architect review and approval of all exterior finish elements materials and construction manner. Comply with provisions of Section 01-3323.

1.5 PRE-INSTALLATION CONFERENCE

- A. Prior to starting roofing and exterior envelope work, the General Contractor shall set up a meeting to comply with provisions of Section 01-3119 for the "Envelope and Roofing Pre-Installation Conference".

1.6 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in accordance with Section 01-6500.
- B. Store and protect products in accordance with Section 01-6600.
 - 1. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and provide ventilation.

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2. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

- A. Prefinished Aluminum Sheet: ASTM B209, alloy, temper, plain.
 1. Gage: As indicated on drawings.
 2. Finish: Factory-applied Kynar 500 fluorocarbon coating.
 3. Color: To be selected by Architect.
- B. Copper: ASTM B370; temper (cold-rolled) except where temper 060 is required for forming; 16 oz/sq. ft. thick unless otherwise noted.

2.2 ACCESSORIES

- A. Solder: For galvanized steel or copper, 50 - 50 tin/lead solder (ASTM B32), rosin flux.
- B. Fasteners: Same metal as flashing/sheet metal. Match finish of exposed heads with material being fastened. Type and size to suit application.
- C. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, free of sulfur, compounded for 15-mil dry thickness per coat.
- D. Sealant: Exterior quality conforming with Section 07-9200.
- E. Paper Slip Sheet: 5-lb. rosin-sized building paper.
- F. Polyethylene Underlayment: 4-mil minimum carbonated polyethylene film tested in accordance with ASTM E154.
- G. Neoprene Washers: Required for all fasteners which will remain exposed to the weather.
- H. Cast-Iron Drainage Boots: Grey iron castings of size indicated, ASTM A48, bituminous shop-coated.
- I. Metal Accessories: Sheet metal clips, continuous cleats, straps, anchoring devices, as required for installation of work, matching or compatible with adjoining materials, noncorrosive, size and gage required for performance.
 1. Continuous cleats shall be 22 gage galvanized metal, fastened 12" max. o.c., unless indicated otherwise.
- J. Roofing Cement: ASTM D4586, asphaltic.
- K. Concrete: Splash block

2.3 FABRICATED UNITS

- A. General: Shop-fabricate work to extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual".

SHOP-FABRICATED SHEET METAL ACCESSORIES AND TRIM 07-6207-3

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1. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to prevent leakage, damage, or deterioration of the work.
 2. Form work to fit substrates.
 3. Form exposed work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
 4. Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer.
 5. Protect metal from noncompatible metal or corrosive substrates by coating with bituminous coating as recommended by manufacturer/fabricator.
- B. Hanging Gutters:
1. Form sections in maximum lengths, true to shape indicated, accurate in size, and free from defects. Unless indicated otherwise, a minimum ratio of the depth to width should be 3 to 4.
 2. Provide for thermal expansion and contraction. Adjacent ends shall be telescoped or enclosed with covers in a manner to accommodate expansion. Expansion shall be away from corners and downspouts.
 3. Support gutters with metal brackets of same material as gutter and of the following size:
 - a. For gutters with girth up to 15" use 1/8" x 1" bracket.
 - b. For gutters with girth from 15" to 20" use 3/16" x 1" bracket.
 4. Joints for prepainted gutters shall be lapped at least 1" and installed in direction of flow and sealed.
- C. Downspouts
1. Form sections in maximum 10 foot or 12 foot lengths in size and shape indicated on drawings. Provide for expansion and contraction. Join in the direction of flow.
 2. Provide 1" x 16 gage flat stock strap hangers of same material as the downspout. Install at elbows or other transitions in the downspouts and not to exceed 5' o.c. Allow 1/2" space between back of downspout and face of wall.
 3. Terminate downspouts above and below grade as indicated on drawings.
- D. Counterflashings:
1. Stainless steel for metal counter flashings embedded in masonry and manufactured stone. For other materials use aluminum.
 2. Comply with details shown to fabricate sheet metal to fit substrates and result in waterproofing and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Non-moving seam shall be flat locked.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection:
1. Before starting the work of this section, verify other work affecting sheet metal work is complete and approved.
 2. Beginning of sheet metal work means acceptance of existing conditions.
- B. For Roofing Work:

SHOP-FABRICATED SHEET METAL ACCESSORIES AND TRIM 07-6207-4

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1. Exercise care when working on or about roof surfaces to avoid damaging or puncturing membranes and flashings.
2. Place plywood panels on roof surfaces adjacent to work of this section and on access routes. Keep in place until completion of work.

3.2 INSTALLATION REQUIREMENTS

- A. Perform sheet metal work in accordance with approved shop drawings and installation instructions and recommendations of SMACNA "Architectural Sheet Metal Manual."
 1. Anchor work securely in place by methods indicated, providing for thermal expansion; conceal fasteners where possible.
 2. Set units true to line and level.
 3. Install work with laps, joints, seams watertight and weatherproof.
- B. Underlayment: For stainless steel or aluminum to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper or a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install counterflashing in reglets, either by snap-in seal arrangements or by wedging in place for anchorage and filling reglet with mastic or elastomeric sealant.
- E. Flashing Attachment:
 1. Secure all flashing 16 inches on centers.
 2. Install parapet cap flashing and gravel guards with continuous hold-down clips secured 12" o.c. maximum.
 3. Exposed fasteners shall be complete with neoprene washers 16" o.c.

3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Protection: Protect flashings and sheet metal work during construction from damage or deterioration.

END OF SECTION

SECTION 07-6507
FLASHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Stainless Steel and EPDM self adhered flashing for concealed wall conditions.
 - 1. Coordinate the work of this section with Sections 04-2113 Brick Masonry, 04-2200 Concrete Masonry Units, 06-1643 - Gypsum Sheathing.

1.2 JOB MOCK-UP

- A. Mock-Up Panel: Before work in this section is started, provide exterior mock-up for Owner and Architect review and approval of all exterior finish elements materials and construction manner. Comply with provisions of Section 01-3323.

1.3 PRE-INSTALLATION CONFERENCE

- A. Prior to starting roofing and exterior envelope work, the Component Contractor shall set up a job site meeting to comply with provisions of Section 01-3119 for the "Envelope and Roofing Pre-Installation Conference".

1.4 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Indicating full compliance with requirements of this section, including installation instructions.
 - 2. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Flashings shall be produced by a manufacturer with not less than five years experience in the fabrication of flashings specified in this section.

1.6 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 EPDM FLASHING

- A. Type: Carlisle's 40 mil self-adhering thru-wall flashing composed of a 32 mil self-adhering rubberized asphalt membrane laminated to a 8 mil high density polyethylene film.
 - 1. Product No.: CCW-705-TWF
 - 2. Thickness: 40 mil
 - 3. Tensile Strength: ASTM D-412, 1200 psi min.
 - 4. Elongation: ASTM D-412, 200% min.
 - 5. Pliability: ASTM D-146, pass @ -25 deg. F, ¼" mandrel
 - 6. Peel Adhesion: D-903, 5 lbs/in. min.
 - 7. Puncture Resistance: ASTM E-154, 80 lbs. min.
- B. Substitutions: The following manufacturers are acceptable: Other manufacturers may be submitted for review in accordance with Section 01-2513.
 - 1. W.R. Grace, www.grace.com
 - 2. Wirebond, www.wirebond.com

2.2 STAINLESS STEEL SHEET METAL FLASHING

- A. Type: ASTM A167, 304, "18-8" Alloy, fully Annealed, Stainless Steel Flashing.
 - 1. Thickness: 20 gauge (0.0359 inch).

2.3 ACCESSORIES

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. General:
 - 1. Verify that existing conditions are ready to receive flashing work.
 - 2. Surfaces to receive flashing shall be reasonably smooth and free from irregularities.
 - 3. Beginning of flashing work means acceptance of existing conditions.

3.2 SHEET METAL FLASHING INSTALLATION:

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall

flashing with installation of wall-opening components such as windows, doors, and louvers.

- B. Openings Flashing: Install continuous head, sill, jamb, and similar flashings to extend 5 inches beyond wall openings.
- C. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashings.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of stainless-steel sheet metal flashing with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- E. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- F. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
- G. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- H. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - 1. Stainless Steel: Use stainless-steel fasteners.
- I. Seal joints as required for watertight construction.
- J. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work. Prein edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
- K. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

- L. Insert specific installation requirements for other sheet metal flashing and trim items specified in this Section if required.

3.3 EPDM FLASHING INSTALLATION:

- A. Priming: Where priming is recommended by EPDM flashing manufacturer, clean surfaces to remove residual dust before priming. Stir primer. Apply by roller at a rate of 300 to 350 sq./ft. per gallon. Allow primer to dry per 1-4 hours.
- B. Vertical Surfaces: Install sheet membrane in horizontal fashion with shingle style overlapping seams. Overlap edge seams 2 ½", end laps 5". Stagger end seams. Roll in place with an 18 to 24" wide roller or broom. Ensure that all laps are firmly adhered and that there are no gaps or fishmouths.
- C. Terminations: Apply fasteners on 6" centers along the top edge of the application to assist in initial adhesion. Roll terminating edges, and seams firmly. Apply sealants or mastic to all terminations and "T" – joints. Provide termination bars where indicated on drawings.
- D. Protection: Cover as soon as construction scheduling allows.

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07-7233
ROOF HATCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Prefabricated roof hatches, complete with integral curb, operable hardware, and counterflashings.
- B. Coordinate requirements with steel ladders specified in Section 05-5000.

1.2 REFERENCE STANDARDS

- A. ASTM D2822 - Asphalt Roof Cement.
- B. SSPC - Steel Structures Painting Manual.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Firm with minimum five years experience in successfully producing roof hatches similar to that specified in this section.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Shop Drawings: Clearly indicate:
 - 1. General construction, configuration and size.
 - 2. Method of securing hatches to roof deck.
 - 3. Relationship of hatches with specified roofing system for watertight installations.
- C. Manufacturer's Product Data: Indicating full compliance with requirements of this section; installation instructions.
- D. Provide name of city and state where materials specified in this section where manufactured.
- E. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.5 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels. Comply with Section 01-6500
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

1.6 WARRANTY

- A. Submit roof hatch manufacturer's guarantee against material defects and workmanship for a period of five years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. General: Roof hatch types specified shall be as manufactured by The Bilco Company/New Haven, Connecticut.
- B. The following manufacturers are acceptable. Other manufacturers may be submitted for review in accordance with Section 01-2513.
 - 1. Babcock-Davis/Arlington, Massachusetts.
 - 2. Milcor Incorp/Lima, Ohio.

2.2 ROOF HATCHES

- A. For Ladder Access with Safety Post:
 - 1. Type: Bilco's TYPE S, single leaf, aluminum construction.
 - 2. Size: 3'-0" x 3'-0".
 - 3. Location: As indicated on Drawings.

2.3 MATERIALS/COMPONENTS/FABRICATION

- A. General: Roof hatches shall be factory assembled, with heavy pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles and padlock hasps inside and outside.
 - 1. Roof hatches shall be designed and fabricated to provide for removal of condensation.
- B. Curb: 12" height, 11 gage, aluminum construction, with 3-1/2" flange with holes provided for securing to roof deck.
 - 1. Curb shall be equipped with an integral metal cap flashing of same gage and material as curb, completely welded at corners for watertightness.
 - 2. Insulation: 1" thick rigid fiberboard on exterior side of curb.
- C. Cover: 11 gage aluminum construction with 1" thick rigid fiberboard fully covered and protected with an 18 gage aluminum liner.
 - 1. Cover shall be complete with thermoplastic rubber gaskets and equipped with an automatic hold-open arm complete with vinyl grip handle to permit easy one hand release.
- D. Hardware Finish: Zinc plated and chromate sealed.
- E. Sealant: See Section 07-9200- Joint Sealers.
- F. Roofing Cement: ASTM D2822.
- G. Bituminous Coating: SSPC - Paint 12, solvent type bituminous mastic, compounded for 15 mil dry film thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations and approved shop drawings.
 - 1. Coordinate with installation of roof deck and roof system to ensure that each element of the work performs properly, and combined elements are waterproof and weathertight.
 - 2. Anchor units securely to supporting structural substrates.
- B. Separate metal surfaces of units from noncompatible metal or corrosive substrates, including wood, by applying bituminous paint.
- C. Set flanges of accessory units in a thick bed of roofing cement, to form a seal.
- D. Test operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.2 CLEANING AND PROTECTION

- A. Clean and protect exposed surfaces in accordance with manufacturer's instructions. Touch up damaged metal coatings.

END OF SECTION

**SECTION 07-8400
FIRESTOPPING**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fireproof firestopping and firesafing materials and accessories.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Indicating full compliance with requirements of this Section; installation instructions, list of proposed use locations and details for each installation.
 - a. Include UL Systems for each type of firestop penetration.
 - 2. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
- B. Applicator: Company specializing in performing the work of this Section with minimum three years documented experience.
- C. Provide materials listed in the UL Building Materials Directory, current edition at time of application, as "Fill, Void or Cavity Materials" and as "Through Penetration Firestop Systems".

1.4 DELIVERY, HANDLING, STORAGE

- A. Firestopping materials shall be delivered in original unopened packages, containers or bundles bearing manufacturer's labels.
 - 1. Labels shall indicate brand name and other descriptive data confirming compliance with specifications.
 - 2. Comply with Section 01-6500.
- B. Store and protect firestopping materials in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.

1.5 REGULATORY REQUIREMENTS

- A. Conform to regulatory requirements indicated on drawings for fire resistance ratings and surface burning characteristics.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Each type of component listed below shall be consistent (the same product and same manufacturer) throughout project, even if installed by separate contractors. General contractor, coordinate the product needs of project and provide consistency.

2.2 SILICONE ELASTOMERIC COMPOUND

- A. Manufacturers/Products:
 - 1. 3M, CP25 WB.
 - 2. Hilti FS601, CP6015
 - 3. SpecSeal, Sil 300
- B. Material: Single component silicone intumescent compound and compatible silicone sealant.
- C. Use: Construction joints, gaps, cable penetrations.

2.3 FORMULATED COMPOUND OF INCOMBUSTIBLE FIBERS OR FIRESTOP MORTAR

- A. Manufacturers/Products:
 - 1. 3M Fire Barrier Mortar
 - 2. Hilti FS635
 - 3. Nelson CMP
- B. Material: Formulated compound mixed with incombustible non-asbestos fibers.
- C. Use: Large openings or penetrations in concrete.

2.4 FIBER STUFFING

- A. Manufacturers/Products:
 - 1. USG's "Thermafiber" Safing Insulation.
 - 2. Reilly-Benton Co., Mineral Wad Insulation.
 - 3. Rock Wool Mfg., Co., Mineral Was Insulation.
- B. Material: Mineral fiber stuffing insulation.
- C. Use: Damming for penetration and gaps.

2.5 MECHANICAL DEVICE FOR PVC PIPE

- A. Manufacturers/Products:
 - 1. 3M Ultra PPD and RC Pack
 - 2. Hilti CP642, CP643
 - 3. Johns Manville, Firestop Collars
- B. Material: Mechanical device with incombustible fillers covered with sheet steel collar, joined with wrap strips and putty, penetration sealed with flanged stops. Maximum size 4".
- C. Use: Non-metallic (PVC) pipe penetrations.

2.6 INTUMESCENT PUTTY

- A. Manufacturers/Products:

1. 3M MPS-2.
2. Nelson FSP.
3. Hilti CP618.

B. Material: Intumescent putty compound which expands on exposure to surface heat gain.

C. Use: Cable and pipe penetrations.

2.7 INTUMESCENT CALK

A. Manufacturers/Products:

1. 3M CP25 WB+.
2. Hilti FS one sealant.
3. Nelson CLK.
4. Johns Manville, CI Caulk

B. Material: One part intumescent synthetic elastomeric water based latex caulking compound designed for use as a through-penetration firestop system.

C. Use: Smoke and fireseal to close annular space around penetrations.

2.8 INTUMESCENT COMPOSITE SHEET/BLOCKS

A. Manufacturers/Products:

1. 3M CS-195.
2. Hilti FS657 Fire Block
3. STI Spec Seal, SSB Firestop Pillows

B. Material: Formed mineral fiber pillows and intumescent foam blocks.

C. Use: Large openings and cable trays.

2.9 FIRESTOP JOINT SPRAY

A. Manufacturers/Products:

1. Hilti CP672
2. Grace Construction Products, Flamesafe FS3000
3. 3M Fire Dam Spray 100
4. Johns Manville SI, SE Firetemp Spray

B. Material: A sprayable fire-rated mastic meeting the requirements of UL2079 "Test for Fire Resistance of Building Joint Systems".

C. Use: Construction joints including top of wall joints, curtain wall/perimeter joints and expansion joints.

2.10 ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

B. Dam Material (Permanent):

1. Mineral fiberbond recommended by firestopping manufacturer
2. Mineral fiber matting recommended by firestopping manufacturer

C. Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

2.11 FINISHES

- A. Color: To match adjacent substrate color at locations considered visible and of aesthetic concern. Coordinate with the Architect for those locations.

2.12 SUBSTITUTIONS

- A. Products of other manufacturers may be submitted for review in accordance with Section 01-2513

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping materials.
 - 1. Remove incompatible materials which may affect bond.
- B. Install backing damming materials to prevent leakage of liquid materials.

3.2 APPLICATION

- A. Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer and materials in accordance with manufacturer's instructions.
- C. Apply firestopping materials in sufficient thickness to achieve rating.

3.3 FIELD QUALITY CONTROL

- A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Patch and repair firestopping caused by cutting or penetration by other trades.

3.4 ADJUSTING AND CLEANING

- A. Clean up spills of liquid components.
- B. Neatly cut and trim materials as required.

END OF SECTION

SECTION 07-9200
JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sealant work as required to make exterior wall joints and similar building joints watertight.
- B. Joint sealing compound for interior work.
- C. Sealant for installation under interior metal stud runners (tracks) is specified in Section 09-2216- Non-Structural Metal Framing.

1.2 QUALITY ASSURANCE

- A. Installer: Shall be trained and have a minimum of five years experience in the techniques of joint sealer applications, and shall be thoroughly familiar with recommendations of manufacturers for the specified joint sealers.
- B. Laboratory Testing:
 - 1. Before starting the exterior sealant work, lab testing for adhesion is required in accordance with ASTM C794 Test Method.
 - 2. Lab testing shall be performed and certified by Sealant Manufacturer.
 - 3. All materials scheduled to come in contact with exterior sealant shall be tested with type of sealant specified.
 - 4. Sealant Manufacturer's Representative shall pick up samples at job-site after being notified by Contractor.
 - 5. Test Reports from Sealant Manufacturer shall be forwarded to Architect for distribution to Contractor and Owner.
 - 6. Lab testing shall be performed at no cost to contractor, Owner and Architect.
- C. Compatibility With Substrate: Manufacturer shall be responsible for verifying that joint sealers used are compatible with joint substrates.
- D. Joint Tolerance: Joint width/depth are critical to joint sealer performance. Compliance with manufacturer's recommendations is required.
- E. Lot/Batch # of Sealant: Contractor shall keep in file the lot/batch # and date of manufacture of each type of sealant approved for the work.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Indicating compliance with requirements of this Section, including installation instructions for each type of joint sealer specified.
 - 2. Samples: Manufacturer's complete color range for each type of joint sealer specified.

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3. Laboratory Test Reports: Certified by Sealant Manufacturer indicating compliance with laboratory testing requirements specified in this Section under "Quality Assurance".
 4. Compatibility and adhesion test reports from manufacturer indicating that materials have been tested for compatibility and adhesion with joints sealants.
 5. Product test reports for each type of joint sealers, indicating compliance with requirements specified.
 6. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals.
1. Warranty: Written warranty and supporting letter as specified elsewhere within this section.
- 1.4 DELIVERY, HANDLING, STORAGE
- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's label in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
1. Maintain temperature and humidity within ranges required by manufacturer's instructions.
- 1.5 JOB MOCK-UP
- A. Mock-Up Panel: Before work in this section is started, provide exterior mock-up for Owner and Architect review and approval of all exterior finish elements materials and construction manner. Comply with Exterior Building Mock-up provisions of Section 01-3323.
- 1.6 PRE-INSTALLATION CONFERENCE
- A. Prior to starting roofing and exterior envelope work, the General Contractor shall set up a job site meeting to comply with provisions of Section 01-3119 for the "Envelope and Roofing Pre-Installation Conference".
- 1.7 WARRANTY
- A. Upon completion and acceptance of the project, furnish to the Owner through the Architect a written guarantee. Guarantee all items and work included in this Section for a period of five years from Date of Substantial Completion, against defective workmanship and materials.
1. This guarantee shall include that the materials in contact with sealant are compatible with sealant.
- B. Defects resulting from faulty materials and/or workmanship during the guarantee period shall be repaired or replaced by the Contractor at his expense.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. General: Each type of sealant specified below shall be complete with accessories and components as specified in this Section and manufactured by Pecora Corporation, www.pecora.com
- B. Substitutions: The following manufacturers are acceptable. Other manufacturers may be submitted for review in accordance with Section 01-2513:
 - 1. Dow Corning Corporation, www.dowcorning.com
 - 2. Tremco, www.tremcosealants.com
 - 3. Sonneborn Building Products a BASF Company, www.buildingsystems.basf.com

2.1 SEALANTS

- A. Medium Modulus Silicone Exterior Wall Sealant:
 - 1. Type: Pecora's "895" one-part medium-modulus, Type II, silicone sealant, non-sag, Class "A", consisting of the following physical properties as tested by Fed. Spec. TT-S-00230C, Class A and ASTM C-920, Class 25, Type S, Grade NS, Use NT, G, A, and O, and approved as by Pecora:
 - a. Ultimate Tensile Strength: 225 psi, ASTM D412.
 - b. Movement Capability: 50% extension, 50% compression.
 - c. Hardness: Durometer 27, ASTM D412.
 - d. Adhesion-in-Peel: 30 lbs. peel strength and 0% adhesion loss on glass or aluminum, ASTM C794.
 - 2. Uses:
 - a. Metal to metal
 - b. Metal to fiber cement siding
 - c. Joints Within: Fiber cement siding.
 - 3. Color: To be selected by Architect from manufacturers premium colors.
- C. Sanitary Mildew Resistant Silicone Sealant:
 - 1. Type: Pecora's "898" one-part, very low odor, neutral-curing silicone for interior applications consisting of the following physical properties as tested by TT-S-001543A, TT-S-00230C, Class A and ASTM C920, Class 25.
 - a. Cyclic Movement (%): +/- 50, ASTM C679
 - b. Elongation, Ultimate (%): 450, ASTM D412
 - c. Hardness, Shore A: 25-35, ASTM C661
 - d. Ozone/UV Resistance: Excellent, weatherometer
 - e. Service Temperature Range (°F): -60 to 300
 - f. Tensile Strength:
 - 1) 100% Elongation (psi): 45-55, ASTM D412
 - 2) Ultimate (psi): 165, ASTM D412
 - g. VOC Content (g/l): 12, ASTM D3960
 - 2. Uses:
 - a. Sealing perimeters of fixtures in bathrooms, kitchens and other hygienic facilities.
 - b. Joints between prefab shower base and floor.
 - 3. Color: To be selected by Architect from manufacturers premium colors.

- D. Acrylic Latex Interior Sealing Compound:
 - 1. Type: Pecora "AC-20" one-part acrylic latex + silicone, non-sag, gun-grade consistency, paintable with latex or oil paint, mildew-resistant, USDA approved, ASTM C834 quality, including the following physical properties by ASTM and approved by Pecora:
 - a. Modulus at 100%: 15-20 psi, ASTM D412.
 - b. Ultimate Tensile: 30-40 psi, ASTM D412.
 - c. Ultimate Elongation: 400-500%, ASTM D412.
 - d. Movement Capability: 7-1/2% extension, 7-1/2% compression.
 - e. Low-Temperature Flexibility: No cracking through to substrate or adhesion loss, ASTM C734.
 - f. Adhesion Loss: 0.2%, ASTM C736.
 - 2. Uses:
 - a. Window/door frame perimeters
 - b. Vinyl, aluminum, steel, wood, gypsum board
 - c. Vanities, shower stalls, countertops, sub-bases, cut-outs at electrical boxes, bath/kitchen fixtures.
 - 3. Color: To be selected by Architect from manufacturers premium colors.

2.2 ACCESSORIES

- A. Primer:
 - 1. For Exterior Wall Joints: If laboratory test reports approved by sealant manufacturer indicate a primer is required for exterior wall joints, then the primer must be non-staining type recommended by sealant manufacturer.
- B. Backer Rods:
 - 1. For Vertical Wall Joints: Pecora #91 DenverFoam Open Cell Polyurethane or Pecora #92 Green Rod Closed Cell Polyethylene.
 - 2. For Horizontal and Inclined Joints: Pecora #92 Green Rod Closed-Cell Polyurethane. Open-cell type is not acceptable for traffic grade sealant work.
 - 3. Size: Use size that will compress 25% when inserted in joint.
- C. Bondbreaker Type: Of type recommended by sealant manufacturer to suit application.
- D. Joint Cleaner: Non-corrosive and non-staining, compatible with sealant, of type recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cleaning of Joints: Clean and prepare joints to comply with recommendations of joint sealer manufacturer.
 - 1. Remove any loose materials and other foreign matter which might impair adhesion of sealant.
- B. Joint Priming: Prime joint substrates where recommended by manufacturer and according to manufacturer's recommendations. Do not allow spillage or migration onto adjoining surfaces.

JOINT SEALANTS 07-9200-5
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- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces. Remove tape after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Backer Rod Installation:

1. Install backer rod in joints using a blunt instrument to avoid puncturing.
2. Do not twist rod while installing.
3. Install backer rods according to manufacturers written recommendations. Depth varies with width.

B. Joint Sealer Application:

1. Do not start exterior building sealant work before Architect has received and accepted the Sealant Manufacturer's certified lab test reports required by this Section.
2. Apply joint sealers in strict compliance with manufacturer's published instructions.
3. Apply joint sealers within temperature ranges recommended by sealant manufacturer. Consult manufacturer when sealant cannot be applied within recommended temperature ranges.
4. Apply joint sealers in joints using pressure gun with nozzle cut to fit joint width.
5. Joint sealers shall be applied in uniform, continuous beads without gaps, air pockets, embedded matter, ridges and sags.
6. Tool the joints to required configuration within the time limit of sealant application recommended by manufacturer.
7. If masking materials are used, remove masking material immediately after tooling.

3.3 CLEANING

- A. As work progresses, remove excess materials adjacent to joints.
- B. Leave finished work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.

3.4 PROTECTION

- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations.
- B. Cut out and remove damaged or deteriorated joint sealers and repair to match original work.

END OF SECTION

SECTION 07-9513
EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Expansion joint cover assemblies for the following building applications:
 - 1. Walls (interior and exterior),
 - 2. Ceilings
 - 3. Floors

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Clearly indicate:
 - a. Expansion joint unit profiles and dimensions.
 - b. Schedule of locations and joint dimensions.
 - c. Method of attachment and type of material to which expansion units will be attached.
 - d. Locations of splices.
 - 2. Schedule of joint covers listing full catalogue order numbers indicating joint size.
 - 3. Manufacturer's Product Data: Indicating full compliance with requirements of this Section, including installation instructions.
 - 4. Selection Samples: One required for each type of metal finish and color for Architect's selection.
 - 5. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Obtain expansion joint cover assemblies from a single manufacturer with a minimum of ten years successful experience in the fabrication of systems similar to that specified.
- B. Installer: Expansion control system shall be installed by a licensed applicator, factory trained and certified in the proper installation of the specified joint system.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels and in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Provide products manufactured by Watson Bowman Acme a BASF company, www.wbacorp.com
 - 1. Substitutions: Products of other manufacturers are acceptable:
 - a. Balco Inc. www.balcousa.com
 - b. Construction Specialties Inc., www.c-sgroup.com
 - 2. Follow Section 01-2513 to submit substitution requests.
- B. See schedule in Part 4 of this specification Section for specific products.

2.2 COMPONENTS AND MATERIALS

- A. Aluminum Extrusions: ASTM B221, alloy 6061-T6 or 6063-T5.
- B. Aluminum Shapes: ASTM B209, alloy 6061-T6 or 5005-H34.
- C. Elastomeric Seals: Flexible extruded polyvinyl chloride.
- D. Anchorage: 1/4" diameter x 1-3/4 lg. (minimum) threaded concrete anchor. Spacing as required by manufacturer.
 - 1. For wall anchorage use drywall screws for sheetrock construction.
 - 2. For masonry or concrete construction use 1/4 inch diameter x 1-3/4 inch lg. (minimum) hex-head threaded concrete anchor.
- E. Accessories: As required for complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Verify that existing conditions including block-outs are ready to receive expansion joint systems.
 - 2. Beginning the work of this Section means acceptance of existing conditions.
- B. Install expansion joint systems in accordance with approved shop drawings and manufacturer's published recommendations.
- C. Install expansion joint systems plumb, level and rigidly in place using accessories recommended by manufacturer.
 - 1. For blockout infill in concrete slabs use manufacturer's high impact, non-shrink grout meeting compressive strength of 8,500 psi in 28 days.
 - 2. Set floor devices at elevations flush with adjacent finish floor materials.
 - 3. Locate wall and ceiling devices in continuous contact with adjacent surfaces.
 - 4. Make splices as recommended by manufacturer.
 - 5. Exposed Butt Joints: Make tight, flush and hairline.

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3.2 CLEANING AND PROTECTION

- A. Do not remove strippable protective material from joint devices until Architect approves the removal.
- B. When Architect permits removal of protective material, remove protective material and clean surfaces in accordance with manufacturer's instructions.

PART 4 - SCHEDULES

4.1 EXPANSION JOINTS

- A. Interior Type System: Fastwrap Series
 - 1. Floor to Floor: Model LPF-200, 2-inch opening, non-rated.
 - 2. Floor to Wall: Model LPF-200C, 2-inch opening, non-rated
 - 3. Wall to Wall: Model CWF-200, 2-inch opening, non-rated
 - 4. Wall to Wall (Corner): Model CWC-200, 2-inch, opening, non-rated
 - 5. Wall to Ceiling: Model CWC-200, 2-inch, non-rated
 - 6. See Drawings for locations of rated joints.
- B. Exterior Type System: Seismic WeatherSeal
 - 1. Wall to Wall: Model SWS-400, 2-inch opening, non-rated*
 - 2. Coordinate locations of wall expansion joint with roofing contractor to ensure a continuous watertight installation. Roofing Contractor is responsible for fusing roofing with wall expansion joint
 - 3. Colors selected from manufacturer's standards.

END OF SECTION

SECTION 08-1113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Steel hollow metal doors, frames. Note that four (4) hollow metal frames as indicated on sheet A6.1 shall be provided by the Construction Manager. All other frames shall be provided by the Component Contractor.
- B. Steel hollow metal frames for doors specified in other Sections of Division 8.
- C. Steel acoustical, leaded and thermal doors and frames.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Product Data: Submit manufacturer's technical data substantiating that products comply with requirements of this Section.
 - 2. Shop Drawings: Indicate details and gages of frames, elevations of doors and frames, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show type of anchorage and accessory items.
 - a. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
 - b. Indicate cutouts for glazing where required in doors.
 - c. Indicate fire-resistance ratings where applicable.
 - d. Coordinate the work of this Section with the requirements for doors specified in other Sections of Division 8.
 - 1) Indicate these requirements on shop drawings.
 - 3. Certification of Fire-rated Assemblies: Submit manufacturer's certification indicating that each type of fire-rated door and frame is fabricated to meet or exceed the requirements of the Contract Documents.
 - 4. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.3 QUALITY ASSURANCE

- A. Each door shall be marked by manufacturers' identifying type and performance.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver metal doors and frames cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory-finished doors. Comply with Section 01-6500.
- B. Inspect metal doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect. Remove and replace refinished units not acceptable to Architect.

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- C. Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to allow air circulation. Comply with Section 01-6600.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. The following manufacturers are acceptable. Other manufacturers are acceptable for evaluation only after compliance with Section 01-2513.
 - 1. Amweld/Div. American Welding and Manufacturing Company.
 - 2. Ceco Corporation.
 - 3. Curries/Div. of Essex Industries.
 - 4. Palmetto Metal Products Inc.
 - 5. Steelcraft/Div. American Standard Company.

2.2 STEEL DOOR FRAMES

- A. Type: Welded-unit construction of cold-rolled steel conforming to ASTM A366, free of defects, warp and buckle.
 - 1. Molded members shall be clean-cut, straight and true.
 - 2. Corner Joints: Die Mitered in true alignment and welded continuously on inside of frame.
 - a. Full weld faces and back of throat.
 - 3. Inserts, Bolts and Fasteners: Manufacturer's standard units, concealed where practical, hot-dip galvanized items to be built into exterior walls, comply with ASTM A153.
 - 4. Welds on Exposed Surfaces: Flush and smooth.
 - 5. Double-return Flanges: Provide for all frames, except for existing openings as indicated on Drawings.
 - 6. Frames Which Wrap Around Wall Openings: Form flanges to fit wall thickness.
 - 7. Trim Angles for door frames: Installed at heads of exterior frames unless otherwise indicated.
 - 8. Spreader Bars for door frames: Each door frame shall be complete with spreader bar welded to bottom of frame.
 - 9. Provisions for Lead Lining: Provide where scheduled.
 - 10. Drip Strips for door frames: Install at heads of exterior in door frames.
Gage/Finish:
 - 11. Exterior Frames: 14 gage, hot-dipped galvanized steel with ASTM A924/G60 or A60 zinc coating; bonderized and coated with zinc-chromate rust-inhibitive primer, baked-on.
 - a. Galvanizing Repair Paint: Cold-Galv. or approved equal.
 - 12. Interior Frames: 16 gage steel, bonderized and coated with zinc chromate rust-inhibitive primer, baked-on.
- B. Provisions in Frames for Door Hardware: Prepare frames at factory for installation of hardware.
 - 1. Mortise, reinforce, drill and tap frames to templates to receive mortised template hinges, lock strikes, flush bolts, and overhead door closers.

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2. Reinforcing Plates: 9 gage offset plates for hinges, 10 gage for mortised hardware and lock strikes, 12 gage for surface-applied hardware, and 14 gage for lock fronts.
 3. Cover Boxes: 26 gage, welded to frame in back of hardware cutouts.
 4. Silencers: Provide three silencers on lock side of single doors and one silencer for each leaf in heads of double-door frames.
 - a. Color: Clear.
- C. Anchors:
1. Door Jamb: Provide galvanized metal clip angle welded to bottom of each jamb member for anchoring to floor construction.
 2. For Metal Stud Partitions: Four 18 gage galvanized steel stud anchors at each jamb up to 7'-6" height; one additional anchor required for each 18 inches or fraction thereof over 7'-6" height.
 3. For lead lined frames provide one additional anchor for wall types specified above

2.3 STEEL DOORS

- A. Type: 1-3/4" thick, flush type, seamless, with two face sheets of 18 gage cold-rolled sheet steel for interior doors and 16 gage for exterior doors conforming to ASTM A366 of sizes indicated on schedule. Vertical stiffeners shall be of channel-shaped steel on nominal 6" spacings, welded to both face sheets.
1. Top and Bottom of Doors: Close with 16 gage steel channels. Exterior doors to have flush tops.
 2. Continuously fill vertical edge joints between face sheets to vertical edge channels, grind smooth, free of exposed seams.
 3. Fill interior doors with spun mineral wool to deaden metallic sound.
 4. Bottom of Doors: Provide 5/8" maximum gap between bottom of doors and concrete floor slab. Undercuts greater than 5/8" are not acceptable.
- B. Finish:
1. Exterior Doors: Hot-dipped galvanized steel with ASTM A924/G60 zinc coating, bonderized and coated with zinc-chromate rust-inhibitive primer, baked-on.
- C. Provisions in Doors for Hardware:
1. Mortise, reinforce, drill and tap to receive template hinges, cylindrical or mortise locks as required, flush bolts and closers.
 2. Provide special reinforcing for bored-type locks and latches.
 3. Reinforcing plates, kick and mop plates, and armor plates.
 4. For doors with window lights, coordinate window height with panic hardware so that hardware does not cross window.

2.4 FIRE RATED STEEL DOORS AND DOOR FRAMES

- A. Fire-Rated Door and Frame Assemblies: Where fire-rated door and frame assemblies are indicated or required, provide fire-rated assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", which have been tested, listed and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.
1. Provide labels on glazing and frames.

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- B. Each fire rated door and frame shall bear Underwriter's Laboratories label.
- C. The labels on UL approved doors and frames must be a permanent type.
 - 1. "Stick-on" type labels are not acceptable.
 - 2. Embossed frames are not acceptable.
 - 3. Labels must be visible after installation.
- D. Doors designated as "20-minute" or greater rating require UL labeled frames.

2.5 STEEL THERMAL DOORS AND FRAMES

- A. Thermal-Rated (Insulated) Doors (ASTM C 1363): Doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu.
 - 1. Locations: At exterior doors and elsewhere as indicated on Drawings.

2.6 PREPARATION FOR GLAZING

- A. Where doors and frames have glazed openings, provide openings with integral stop on one side.
 - 1. Provide 18 gage steel removable glazing stop for other side.
 - 2. Form corners of removable stops with butted hairline joints.
 - 3. Prepare removable stops for installation with countersunk sheet metal screws spaced at not more than 8 inches on centers.
 - 4. Door lite frames and stops shall be flush type to avoid possible conflict with panic devices.

PART 3 - EXECUTION

3.1 FRAME INSTALLATION

- A. General:
 - 1. Install frames, and accessories in accordance with final shop drawings and SDI-105, "Recommended Erection Instructions For Steel Frames".
 - 2. Except for frames located at in-place construction place frames prior to construction of enclosing walls and ceilings.
 - 3. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set.
 - 4. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 5. Install calking and sealant as specified in Section 07-9200.
- B. Install fire-rated frames in accordance with NFPA Standard No.80.
- C. In Metal Stud Partitions:
 - 1. Install hollow metal frames in close coordination with metal studs and gypsum work.
 - 2. Attach anchors to metal studs.
 - 3. Where door frames are scheduled or detailed to be reinforced by structural steel built into partitions, attach jamb anchors to structural steel.

3.2 DOOR INSTALLATION

- A. Install doors in accordance with approved shop drawings.

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- B. Doors shall fit squarely with frames and operate properly.
 - 1. Except as otherwise indicated, door clearances shall be not more than 3/32" at jambs and heads, and 5/8" maximum at bottom between door and concrete floor slab.
 - C. Install hardware without forcing, with proper clearances and alignment, so that operation is smooth and easy, free of binding and/or twisting.
 - D. Coordinate the work of this Section with panic devices which cross over flush type door lite frames and stops.
 - E. The installed fire-rated frame and door assemblies shall conform to NFPA Standard No. 80
 - F. Coordinate installation of glass and glazing with Section 08-8100.
- 3.3 ADJUST AND CLEAN
- A. Adjust doors and hardware for smooth and balanced door movement.
 - B. Clean up hardware and adjacent surfaces upon completion. Do not use abrasives or liquid cleaners that will harm finishes.
 - C. After installation, Contractor shall touch-up scratched and damaged surfaces.
 - 1. Dented or bent frames and doors shall be repaired as required with metal putty, sanded and primed with type of primer to match shop coating.
 - 2. Damaged units which cannot be repaired to meet Architect's approval shall be replaced with new units.

END OF SECTION

**SECTION 08-1400
WOOD DOORS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Solid core veneered doors flush design with plastic laminate faces, of non-rated, fire-rated, lead lined types.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
- B. Perform work in accordance with AWI Quality Standard Section 1300.
- C. Affix the AWI Quality Grade Stamp to each unit of product. Display grade as specified for each Section of work.
- D. Finish doors in accordance with AWI Quality Standard Section 1300.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Door Schedule: Using same reference numbers for openings as those indicated on Architect's Door Schedule.
- C. Shop Drawings and product data indicating:
 - 1. Door Elevations.
 - 2. Location and type of provisions in doors for scheduled hardware attachment.
 - 3. Door construction showing type of core, type of stiles, rails, and internal blocking for hardware attachment.
 - 4. Thickness and type of veneer and crossbands.
 - 5. Type of finish for all door edges.
 - 6. Cutouts for glazing where required in doors.
 - 7. Fire-resistance ratings where applicable.
 - 8. Doors with lead lining.
 - 9. Doors with thresholds, undercut bottom edges and other special features.
 - 10. Type of glass stops.
 - 11. NOTE: Shop fabrication work tickets are NOT acceptable submittals.
 - 12. Coordinate the work of this Section with the requirements of frames specified in other Section of Division 8.
- D. Manufacturer's Product Data: Clearly describing full compliance with requirements of this Section including quality of door construction, core material, face veneers and fire rating.
- E. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

- F. Samples: Submit finish samples indicating the complete finish appearance for Architects approval.
 - 1. Size: 8-1/2 inches x 11 inches x 1/4 inches min.

1.4 DELIVERY, HANDLING, STORAGE

- A. Doors shall be delivered to job-site in accordance with Section 01-6500.
- B. Store and protect doors in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Store doors flat on a level surface in a dry, well-ventilated building. If doors are stored at the job-site for more than one week, all edges **MUST** be sealed using type of sealer recommended by manufacturer.
 - 2. Do not store doors on edge.
 - 3. Cover doors to keep clean and avoid discoloration with an opaque covering which does not permit light to penetrate. Covering **MUST** allow air circulation.
 - 4. Do not subject doors to extremes of heat and/or humidity conditions. Relative humidity shall not be less than 30 percent or more than 60 percent.
 - 5. Handle doors with clean gloves. Do **NOT** drag doors across one another or across other surfaces.

1.5 PRE-INSTALLATION CONFERENCE

- A. Prior to starting door hardware installation work, the General Contractor shall set up a job site meeting to comply with provisions of Section 01-3119 for the "Door Hardware Pre-Installation Conference".

1.6 WARRANTY

- A. Contractor shall furnish the door manufacturer's written certificate guaranteeing the doors against warpage, delamination, telegraphing and faulty materials for the "life of original installations".

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products manufactured by one of the following:
 - 1. Graham
 - 2. Mohawk
 - 3. Marshfield
 - 4. VT Industries
 - 5. Osh Kosh

2.2 NON-RATED DOORS

- A. Door Construction: Non-rated doors shall be fabricated to meet the requirements of NWWDA IS-I, latest edition and AWI Sections 1300 and 200, PC-HPDL-5 including the following:
 - 1. Thickness: 1-3/4 inches.
 - 2. Door Veneers: As specified under "Veneer" in this Section.

3. Crossbands: Two ply hardwood cross-grained crossbands concealed at edges. (Crossbands are absolutely required under each face veneer from all manufacturers).
4. Core: 30 pounds per cubic foot average density particleboard, ANSI A208.1 quality. Drop-in core note acceptable.
5. Stiles: 1-3/8 inch wide (before prefitting) one or two piece hardwood, out edge same species as face veneer for transparent finish.
6. Rails: 1-3/8 inch wide mill option hardwood. Bottom rails for doors exceeding 8'-0" in height shall be 2-3/4 inches.
7. Strike Edges: Beveled.
8. Prefitted to Frames at Factory: Required.
9. Top and bottom rails shall be factory sealed with an approved wood sealer. Site trimming of rails requires re-sealing.
10. Premachined for Scheduled Hardware at Factory: Required.
11. Finish: Shop finish in accordance with AWI- Section 1300 and 1500 systems. Door edges shall be sealed following fitting.

2.3 FIRE-RATED DOORS

- A. Door Construction: Each type of fire-rated door shall be fabricated to meet the requirements of NWWDA IS-1, latest edition and AWI Sections 1300 and 200, FD-HPDL-5 including the following:
 1. Thickness: 1-3/4 inches.
 2. Door Veneers: As specified under "Veneer" in this Section.
 3. Crossbands: Two ply hardwood cross-grained concealed at edges. (Crossbands are absolutely required under each face veneer from all manufacturers).
 4. Core: Kiln-dried wood blocks maximum 2-1/2 inches in width, joints staggered, edge glued. Non-combustible mineral core for 3/4 hour, 1 hour, 1-1/2 hour doors.
 5. Stiles for 20 Minute Doors: 1-3/8 inch thick, 1 or 2 piece matching hardwood.
 6. Stiles for 3/4 Hour, 1 Hour, 1-1/2 Hour Doors: 3/4 inch hardwood with sub-stile as required for manufacturer to warrant for use of butt hinges. Manufacturer shall drill 5/32 inch pilot holes for mortise butt hinges, closers and other scheduled hardware.
 7. Rails for 20 Minute Doors: 1-3/8 inch hardwood, top and bottom.
 8. Rails for 3/4 Hour, 1 Hour, 1-1/2 Hour Doors: 1-1/2 inches for 3/4 hour, 2-3/8 inches for 1 hour and 1-1/2 hour, top and bottom.
 9. Strike Edges: Beveled.
 10. Prefitted to Frames at Factory: Required.
 11. Top and bottom rails shall be factory sealed with an approved wood sealer. Site trimming of rails requires re-sealing.
 12. Premachined for Schedule Hardware at Factory: Required.
 13. Fire-rated doors shall be labeled and classified by Underwriters Laboratories (UL).
 14. Fire-Rating Labels: Permanent type required on hinge edges of doors. Decal type is NOT acceptable.
 15. Astragal: Factory installed metal astragal which meet requirements of Warnock Hersey, U.L. and IBC Coordinate with Finish Hardware Section 08-7100.
 16. Bottom of Doors: 5/8 inch maximum undercut required. More than 5/8 inches not acceptable.
 17. Finish: Shop finish in accordance with AWI- Section 1500 systems. Door edges shall be sealed following fitting.

- B. Positive Pressure Requirements for Wood Doors: Doors shall include all requirements as part of the door construction per "Category A" guidelines as published by ITS/Warnock Hersey. No intumescent is allowed on the frame.
 - a. Supply 5050 smoke seal at head and jambs in conjunction with 9810 intumescent material for positive pressure requirements. Supply type 9500 at meeting edges of fire doors. These requirements apply to 45 minute, 60 minute and 90 minute fire doors.
- 18. Door manufacturer shall submit to Architect certified installation instructions with verification that Underwriters Laboratory (UL) or Intertek Testing Services/Warnock-Hersey has certified the installation instructions.

2.4 LEAD-LINED DOOR

- A. Door Construction: Each lead-lined door shall be fabricated to meet the requirements of WDMA I.S. 1-A Quality Grade; Premium, including the following:
 - 1. Thickness: 1-3/4".
 - 2. Door Veneers: Face veneers and vertical stile edges shall be compatible with non-rated doors. As specified under "Veneer" in this Section.
 - 3. Crossbands: 1/10" high density fiberboard (HDF). (Crossbands are absolutely required under each face veneer from all manufacturers).
 - 4. Core: 28-32 lb/cu.ft. average density particleboard, grade 1-LD-2, for lead-each-side construction.
 - 5. Inner Stiles: 1-3/8" (before prefitting), structural composite lumber (SCL) with the out stile to be the same species as the face veneer. The nominal 1/4" outer stile shall be applied prior to beveling doors.
 - 6. Rails: Structural composite lumber (SCL), 1-3/8" wide (before prefitting) for lead-each-side construction.
 - 7. Lock and hinge stiles, beveled 1/8 inch in 2 inches.
 - 8. Bottom of Doors: 5/8" maximum undercut is required between bottom of doors and concrete floor slab. More than 5/8" is NOT acceptable.
 - 9. Prefitted/Premachined at Factory: Required.
 - 10. Lead Lining: Shall be of thickness and quality conforming to Shielding Study provided by Owner in compliance with governing codes. Integrity of lead-lining shall be maintained.
 - 11. Lead lined steel light frames shall be furnished for light openings with a maximum opening size of 256 square inches on 20 minutes doors.
 - 12. Door edges shall be sealed following fitting.

2.5 VENEER

- A. Interior Doors:
 - 1. Plastic Laminate: Premium grade, complying with NEMA LD3, Grade HGS.
 - a. Face Veneer: .050 inch high density plastic laminate.
 - b. Vertical Edges: .050 inch high density plastic laminate.
 - c. Pair Matching: Compatible match
 - d. Colors/Pattern/Finish: As scheduled.

2.6 ACCESSORIES

- A. Accessories shall be installed in factory.

- B. Glass Type: As specified in Section 08-8100 and as scheduled.
- C. Glass Stops:
 - 1. For Non-Rated Doors: Rolled steel type, primed, mitered corners.
 - 2. For Fire-Rated Doors: Rolled steel type designed to meet UL fire-rating requirements, primed, mitered corners.
 - 3. Door lite frames and stops shall be flush type to avoid possible conflict with panic devices.
- D. For doors with window lights, coordinate window height with panic hardware so that hardware does not cross window.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before installing doors, examine door frames and verify that frames are of correct type and properly installed.
 - 1. Verify that fire-rated doors correspond with fire-rated frames.
- B. If conditions exist which are unsatisfactory for the installation of doors, Contractor shall be notified immediately in writing.
 - 1. Do not proceed with door installation until unsatisfactory conditions are corrected in compliance with Contract Documents.

3.2 INSTALLATION

- A. General: Handle doors with clean gloves.
 - 1. Do not drag doors across doors.
 - 2. Do not drag doors across floor.
- B. Install doors in accordance with approved shop drawings and manufacturer's recommendations.
 - 1. Fire-rated assemblies shall be installed in accordance with NFPA Standard No. 80 and to Warnock Hersey requirements.
 - 2. Doors shall be installed plumb, and fit square in frame with maximum diagonal and vertical distortion of 1/16 inch.
 - 3. The completed door work shall be complete with accessories as specified in this Section and in accordance with Contract Documents.
- C. Door Clearances:
 - 1. 1/8" at jambs and heads.
 - 2. 1/8" at meeting stiles for pairs of doors.
 - 3. At Thresholds: As required to comply with scheduled door hardware.
- D. Door Hardware: Installation shall be in accordance with Section 08-7100.
 - 1. Install door hardware without forcing, with proper clearances and alignment, so that operation is smooth and easy, free of binding and/or twisting.
 - 2. Strength of door shall NOT be impaired when cutting or altering door for installation of hardware.
- E. Glass and Glazing: Shall be as specified in this Section and coordinated with Section 08-8100.

3.3 ADJUSTING/CLEANING/PROTECTING

- A. Adjust doors and hardware under provisions of Section 01-7700.
 - 1. Rehang or replace doors which do not swing or operate freely, as directed by Architect.
 - 2. Refinish or replace doors damaged during installation as directed by Architect.
- B. Clean-up hardware and adjacent surfaces upon completion.
 - 1. Do not use abrasive or liquid cleaners that will harm permanent finishes.
 - 2. Protect door surfaces at all times.
- C. Protection: Completed door work shall be protected from damage and deterioration until final acceptance of the Work.

END OF SECTION

SECTION 08-3100
ACCESS DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Access doors for gypsum board walls, gypsum board ceilings.

1.2 QUALITY ASSURANCE

- A. For the purpose of designating the minimum aesthetic, functional and quality standards for the work of this Section, proprietary products are specified.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Clearly indicating general construction, thickness of metal, type and thickness of finish, and UL Rating.
 - 2. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels.
 - 1. Comply with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 – PRODUCTS

2.1 ACCESS DOOR FOR GYP. BOARD WALLS AND CEILINGS (NON-RATED)

- A. Manufacturer: Provide products manufactured by Milcor, www.milcorinc.com
 - 1. Substitutions: The following manufacturers are acceptable:
 - a. J. L. Industries, a subdivision of Activar www.activarcpg.com/jl-industries
 - b. Karp Associates, www.karpinc.com
- B. Type: Style DW, non-rated, frame and panel assembly for flush wall installations as manufactured by
 - 1. Size: As required for appropriate access.
 - 2. Frame: 16 gage steel with galvanized steel drywall bead.
 - 3. Door Panel: 14 gage steel removable by taking pin out of hinge leaf.
 - 4. Provide two keys for each door.
 - 5. Hinges: Double-acting concealed spring hinges for 175□ opening.
 - 6. Lock Assembly: Key-operated cylinder type, self-latching, with mechanism to release latch bolt from inside.
- C. Finish: Steel shall be chemically bonded with prime coat of baked-on electrostatic powder.

1.1 ACCESS DOOR FOR GYP BOARD WALLS (FIRE-RATED)

- A. Manufacturer: Provide products manufactured by Milcor, www.milcorinc.com
 - 1. Substitutions: The following manufacturers are acceptable:
 - a. J . L. Industries, a subdivision of Activar www.activarcpg.com/jl-industries
 - b. Karp Associates, www.karpinc.com
- B. Type: Fire-rated Ceiling Door for gypsum board ceilings. Frame and panel assembly shall be manufactured under Factory Inspection Service of Underwriters' Inc., and shall bear a UL label for a one-hour non-combustible floor/ceiling system.
 - 1. Size: As required for appropriate access.
 - 2. Frame: 14 gage steel.
 - 3. Door Panel: 20 gage steel, panel sides, 26 gage panel hat channel, equipped with an automatic closing mechanism and white ceramic fiberboard attached to outside of door panel.
 - a. Provide two keys for each door.
 - 4. Hinges: Continuous piano-type.
 - 5. Lock Assembly: Key-operated cylinder type, self-latching, with mechanism to release latch bolt from inside.
- C. Finish: Steel shall have chemically bonded prime coat of baked-on electrostatic powder. Exposed edges shall be primed with rust-inhibitive paint.

2.2 ALUMINUM FLOOR ACCESS DOORS

- A. Manufacturer: Provide products manufactured by Acudor Products Inc, www.acudor.com.
 - 1. Substitutions: The following manufacturers are acceptable:
 - a. J . L. Industries, a subdivision of Activar www.activarcpg.com/jl-industries
 - b. Karp Associates, www.karpinc.com
- B. Type: non-rated, frame and panel assembly.
 - 1. Model: FA-300
 - 2. Sizes: 30-inches by 48-inches.
 - 3. Door: 1/4" aluminum diamond plate reinforced for live load of 300 pounds/sq ft.
 - 4. Stainless steel butt hinges with tamperproof stainless steel bolts and nuts

PART 3 - EXECUTION

3.1 GENERAL

- B. Install access doors plumb, level, rigidly secured in place and in accordance with manufacturer's published recommendations.
- C. Install fire-rated access doors in accordance with UL requirements, as applicable to fire-rated access doors.

END OF SECTION

SECTION 08-3323
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exterior coiling insulated service door with accessories and components for a weathertight installation.
- B. Electrical connections are specified in Division 26.

1.2 QUALITY ASSURANCE

- A. Provide exterior coiling insulated service door as a complete unit produced by one manufacturer including hardware, accessories, mounting and installation components.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Shop Drawings: Clearly indicate the following:
 - 1. Design and installation details.
 - 2. Hardware locations.
 - 3. Type of metal and finish for curtain.
 - 4. Finish for miscellaneous components and accessories.
 - 5. Electrical requirements and information indicating installation and operation are in compliance with NEMA, UL.
 - 6. Size and type of operator for motor-operated doors.
- C. Manufacturer's Product Data: Indicating full compliance with requirements of this Section and Contract Documents.
- D. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels and in compliance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: Provide products manufactured by Cornell Ironworks, www.cornelliron.com
- B. Substitutions: The following manufacturers are acceptable. Other manufacturers are acceptable for evaluation only after compliance with substitution requirements specified in Section 01-2513.
 - 1. Cookson
 - 2. O.H Door

2.2 COILING INSULATED SERVICE DOOR

- A. Type: Model: ESD20

2.3 MATERIALS

- A. Curtain:
 - 1. Slat Material: No. 6F:
 - a. Galvanized Steel/Galvanized Steel: 22/22 gauge, Grade 40, ASTM A 653 galvanized steel zinc coating.
 - b. Insulation: 7/8 inch (22 mm) foamed-in-place, closed cell urethane.
 - c. Total Slat Thickness: 15/16 inch (24 mm).
 - d. Slats have a Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
 - e. Slat has an R-value of 8.0 and an STC rating of 26.
 - 2. Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge.
 - 3. Fabricate interlocking sections with high strength nylon endlocks on alternate slats each secured with two ¼" (6.35 mm) rivets. Provide windlocks as required to meet specified wind load.
 - 5. Interior Slat Finish:
 - a. GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
 - 6. Bottom Bar Finish:
 - a. Interior Face: Powder coat to match slats.
- B. Guides: Fabricate with minimum 3/16 inch (4.76 mm) structural steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.
 - 1. Top 16 ½" (419.10 mm) of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.
 - 2. Finish: Steel: Phosphate treatment followed by baked-on polyester powder coat, black color.
- C. Counterbalance Shaft Assembly:
 - 1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
 - 2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

- D. Brackets: Fabricate from minimum 3/16 inch (5 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
 - 1. Finish:
 - a. Steel: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.
 - a. Phosphate treatment followed by a corrosion inhibitive baked-on zinc-rich gray polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.
 - a. ASTM A 123, Grade 85 zinc coating, hot-dip galvanized after fabrication.
 - a. Phosphate treatment followed by baked-on polyester powder coat, black color; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
- E. Hood: 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.
 - 1. Finish:
 - a. GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, black color; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
- F. Weatherstripping:
 - 1. Bottom Bar, Motor Operated Doors: Weather/sensing edge with neoprene or rubber astragal extending full width of door bottom bar.
 - 2. Guides: Replaceable vinyl strip on guides sealing against fascia side of curtain.
 - 3. Lintel Seal: Nylon brush seal fitted at door header to impede air flow.
 - 4. Hood: Neoprene/rayon baffle to impede air flow above coil.

2.3 ACCESSORIES

- A. Locking: Masterkeyable cylinder operable from either coil or fascia side of bottom bar; coordinate with Architect for side of bottom bar to locate cylinder. Provide interlock switches on motor operated units.
- B. Operator and Bracket Mechanism Cover: Provide 0.040 inch (1.016 mm) aluminum sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.

2.4 OPERATION

- A. Supply Cornell Model MG, industrial duty - rated for a maximum of 20 cycles per hour, UL listed, Totally Enclosed Non Ventilated gear head operator, rated 1/2 hp, 120 Volts, Single Phase. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist and control station(s). Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position. Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with #50 roller chain. Operator shall be capable of driving the door at a

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speed of 8 to 9 inches per second (20 to 23 cm/sec). Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.

1. Control Station: Recess mounted, Key switch controlled "Up" and "Down" push button, and "Stop" push button. To be located as directed by Architect.
- B. Weather/Sensing Edge: Provide automatic stop control by an automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar.
 1. Provide an electric sensing edge device. Contact before door fully closes shall cause door to immediately stop downward travel. Provide a self-monitoring wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator. Supervised system alters normal door operation preventing damage, injury or death due to an inoperable sensing edge system.
 1. Provide an electric sensing edge device. Contact before door fully closes shall cause door to immediately stop downward travel. Provide a wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 1. Verify that existing conditions are ready to receive coiling door work.
 2. For motor-operated coiling door, coordinate door work with electrical requirements/Division 16.
 3. Beginning of door work means acceptance of existing conditions.
- B. Install rolling door in accordance with approved shop drawings and manufacturer's published instructions.
- C. Lubricate, test and adjust door to operate easily, free from warp, twist or distortion.

END OF SECTION

SECTION 08-4229
AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Automatic aluminum and glass door systems of the following type complete with sidelights, header, operation, and actuating controls.
 - 1. Single Sliders
 - 2. Folding
- B. Coordinate with glazing specified in Section 08-8100.
- C. Coordinate door hardware requirements with Section 08-7100.

1.2 SYSTEM REQUIREMENTS

- A. Wind Load Requirements (For Exterior Installation in 120 mile/hour zones): 25 lbs.
- B. Comply with ADA Guidelines and governing accessibility codes.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Provide automatic entrance doors produced by a single manufacturer, a member of American Association of Automatic Door Manufacturers (AAADM) and with not less than 10 years successful experience in the fabrication of doors of the type and quality required.
- B. Installer: An authorized representative of the automatic entrance door manufacturer and with not less than 3 years experience in the installation and service of automatic entrance door assemblies.
- C. Certification: All labor and equipment shall be provided by American Association for Automatic Door Manufacturers (AAADM) certified installers and distributors.

1.4 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Describing quality and performance of automatic operating doors, and compliance with NFPA safety requirements.
 - 2. Shop Drawings: Clearly indicate the following:
 - a. Elevations of entrance door systems.
 - b. Method of anchoring door frames to structure.
 - c. Details at floor, ceiling and side walls.
 - d. Types and locations of automatic equipment.
 - e. Types of weatherstripping for weathertight installations.
 - f. Type of glass and glazing beads.
 - g. Type of controls.
 - h. Electrical requirements.
 - i. Details of subsills at sidelights.
 - 3. Certification: Proof of AAADM Certification.

4. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
 5. Maintenance Data: Describing manufacturer's parts list and maintenance instructions for each type of operator.
 - a. Wrenches and Tools: Submit for maintenance of equipment.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals.
1. Warranty: As specified elsewhere within this section.
- 1.5 DELIVERY, HANDLING, STORAGE
- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels and in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
1. Maintain temperature and humidity within ranges required by manufacturer's instructions.
- 1.6 JOB CONDITIONS
- A. Verify that other trades are complete before installing the automatic folding door system.
- B. Mounting surfaces shall be plumb, straight and secure; substrates shall be of proper dimension and material.
- 1.7 WARRANTY
- A. Manufacturer's one-year written warranty on automatic operators and controls against defects and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer Stanley Access Technologies, www.stanleyaccess.com
1. Substitutions: The following manufacturers are acceptable: Products of other manufacturers may be submitted for review in accordance with Section 01-2513
 - a. Beasam Inc., www.besam.com
 - b. Horton Automatics, www.hortondoors.com

2.2 AUTOMATIC SLIDING DOORS

- A. General: Each type of sliding entrance door system specified in this section shall be "DURA-GLIDE SERIES 3000" complete with sliding doors transom and sidelights of aluminum and glass construction, header, operator, actuating controls and thresholds.
1. Automatic entrance equipment shall comply with ANSI A156.10.
 2. In the event of a power failure, doors must be able to be opened manually and be able to close like any door-closer-controlled doors.

3. Door operation must comply with NFPA 101 - Life Safety Code for "emergency breakaway" requirements.
 4. All equipment must operate between -20 degrees F and 120 degrees F in all climate conditions.
- B. Single Slider:
1. Type: "3000 Single Slide" with sidelight and transom.
 2. Size: As scheduled.
 3. Type of Control: "Stan-Guard" threshold sensor, SU050 Motion Detector, Photoelectric Beam Control System, and Directional Motion Sensor (with safety search circuitry).
 4. Locks: Where required (reference Section 08-7100) provide automatic locking system, complete with concealed vertical rod, fail-safe type tamper-proof panic hardware, remote access console (reference Section 08-7100 for locations), and electric solenoid locking device. Locking device shall not interfere with egress.
 5. Threshold: Manufacturer' standard continuous recessed.
 6. Finish/Coated: Kynar 500 fluorocarbon coating, color to be selected by Architect from manufacturer's premium options.

2.3 AUTOMATIC FOLDING DOORS

- A. Type: Stanley's Bifold SB 600 Series consisting of electro-mechanical swing door operator, sensors for actuation and safety, aluminum construction, complete with glazing, hardware and accessories required for exterior installations.
1. Size: As scheduled.
 2. Operator: Magic-Swing electro-mechanical swing door operator installed in header. Push plate mounted on wall.
 3. The operator shall have built-in emergency release per ANSI A156.10.
 4. Doors shall be capable of "breaking out" at any point in their travel to allow full opening for emergency egress.
- B. Aluminum Frame and Extrusions: Shall be a minimum .125 inch wall thickness.
- C. Finish/Coated: Kynar 500 fluorocarbon coating, color to be selected by Architect from manufacturer's premium options.
- D. Header Case: Shall be aluminum extrusion with structurally integrated end caps or brackets. Access to the operator and electronic control box shall be provided by a full length removable cover. The header shall conceal and protect the operating system and shall provide a replaceable guide track, on its bottom surface, for the sliding panel and emergency breakout. The guide track shall direct a follower mounted on the top of the leading edge of the slide panel while at the same time allowing breakaway at any point in the slide panel's travel. The swing leaf shall pivot at the jamb, connected at the top to the operator shaft and set on a floor mounted bottom pivot. Floor track not required.
- E. Door Panels:
1. Shall be constructed for resistance of torque tendencies associated with swing door panels.
 2. Hinges shall be low profile, non-maintenance 3/8 inch thick minimum extruded.
 3. Studs shall be low profile at fold point.

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4. Top and bottom rails, extrusion thickness shall be .150 inch minimum. Doors shall be constructed with through bolt tie rod system.
5. Top rail extrusion shall be .233 inch at power operator door arm attachment.

F. Power Units:

1. Operation: Power open, spring close operation.
2. Operator: Magic-Swing Commercial Grade Operator. Magic-Swing operator shall have heavy duty rack and pinion drive mechanism with a pre-load compression spring.
3. Electric Type: Fractional horsepower DC motor with microprocessor based controller with reverse-on-obstruction programming.
4. Control box shall be microprocessor based with an encoder to monitor door position.
5. Folding panels hinge location shall have silicone rubber fingerguard. Pivot side at door power panel shall have a silicone rubber fingerguard. The lead edge stiles of the FX panel shall have Lead Edge Safety Seal(s), a silicone rubber cushion insert with double pile weatherstripping.
6. Provide flush set neoprene insets to ensure crush point protection at lead edge stiles of door panels.
7. Equipment shall be configured with a two-point locking system.
8. Equipment shall include surface adjustable pivots, surface applied with matching threshold.

G. Electrical Characteristics and Components:

1. 120 Volts AC
2. Single phase 60 Hz

H. Thresholds: Flush with finish floor surfaces.

I. Optional Controls: Furnish and install the following:

1. Push plates
2. Access control lock
3. Alarm contact

J. Coordinate with functional door narrative in Section 08-7100.

2.4 MATERIALS/COMPONENTS/FABRICATION

- A. Extrusions: .125" minimum wall thickness, 6063-T5 alloy and temper (ASTM B221 alloy and temper G.S. 10A-T5).
- B. Exposed Fasteners: Stainless steel, ASTM B633 quality.
- C. Perimeter Anchors: Aluminum or steel, providing the steel is properly isolated from the aluminum.
- D. Operator:
 1. Sliding door system shall be driven by an electro-mechanical operator and a regulated electronic controller.
 2. Operator shall be complete with position controller and electronic control box factory-set to provide operating speeds and forces as prescribed by ANSI A156.10. Belt drive only. Limit switches of any type not acceptable.

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3. Control box in conjunction with position sensor shall automatically set the opening and closing speeds, the opening and closing check positions and the full open and fully closed position of the door system.
 4. Time Delay: Door system shall provide a 0 to 30 seconds time delay.
- E. Header:
1. Shall be extruded aluminum to which operator and door mounting components are attached, complete with self-locking hinged cover.
 2. Shall be capable of supporting bi-parting doors with a deflection of less than .1 inch.
- F. Sliding Doors:
1. Doors shall slide on nylon wheels with stainless steel life-time lubricated ball-bearing centers.
 2. Door height shall be adjustable $\pm 1/8$ " as required by field conditions.
 3. Doors shall be held in track by means of anti-riser wheels, with adjustments fully accessible.
 4. Doors shall be supported from hangar assembly by a factory-adjusted cantilever support and pivot assembly which will allow sliding panels to swing outward for emergency egress without the need for a lower door pivot support.
 5. Sidelights shall swing out and allow sliding doors to "breakaway" to the full open position to provide instant egress at any point in the doors movement in compliance with NFPA 101.
 6. Doors in the full "breakout" mode shall provide double the normal entrance opening.
 7. Sliding door system shall include a two-point lock securing the lead edges of SX door styles together and to the hangar assembly (or in case of a single slide to jamb and hangar assembly).
 8. Door Package shall include security hooks that latch the swing outside panels in closed position when sliding doors are in the fully closed position.
 9. Door holders shall be provided for all panels to control doors as they swing in direction of egress.
 10. Glass Stops: Removable type for all door panels.
- G. Locks: As specified in this section and in accordance with NFPA 101.
- Glass: Of type and quality specified in Section 08-8100 and as scheduled, complete with removable glass stops.
- H. Subsills for Sidelights:
1. Fabricate to shapes indicated of not less than 1/8 inch thick extruded aluminum, one piece full length of opening if practical, with concealed anchors.
 2. If not practical to use one piece, provide 6 inch long back-up plate of same material, thickness and shape as sill member. Provide for expansion and contraction. Line center of subsill with expansion joints in window mullions.
 3. Subsills turned-up back edge not less than 1 inch. Front edge provided with 1-1/2 inch (minimum) drip. End dams furnished-up 1-1/2 inch.
 4. Do not bridge thermal breaks.
 5. Refer to drawings for details.
- I. Door system shall be complete with:
1. Adjustable nylon sweeps on bottom of sliding doors.
 2. Double pile weatherstripping on lead edges of sliding doors including the area of lock.

3. A selector switch located on inside of building which allows doors to open at full or reduced width according to weather and traffic condition.

- J. Threshold Safety:
 1. Door supplied with StanGuard overhead mounted Presence Sensor to prohibit premature door closing, when threshold area of door is occupied.

- K. Overhead Door Control:
 1. Shall be motion detecting sensors that will detect objects moving at a rate of two or more inches per seconds within a semi-circle approximately five feet deep and five feet wide when pointed 84" above floor level, complying with FCC Rules Part 15 and which will not cause harmful interference.
 2. Overhead operator shall be complete with anti-vandalism which will insure that the change of zone size by unauthorized movement of the unit is not possible.
 3. Overhead operator shall have a discriminating signal input circuit, automatic compensation for voltage variations, and automatic rejection of fixed objects within the zone.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 1. Verify that existing conditions are ready to start automatic entrance door work.
 2. Beginning of entrance door work means acceptance of existing conditions.

- B. Install doors and equipment following approved shop drawings and manufacturer's published instructions.
 1. Install door assemblies plumb, level and free of warp or twist.
 2. Maintain dimensional tolerances and alignment with adjacent work.
 3. Provide for thermal expansion and contraction of door and frame units.
 4. Provide for dimensional stressing during operation.

- C. Coordinate installation of components including controls with related and adjacent work and to comply with accessibility requirements.

- D. Set subsills in bed of mastic with provisions for sealant and shims.

- E. Adjustment: After repeated operation of completed installation, re-adjust door operators and controls for optimum condition, safety, and compliance with accessibility and governing building codes.

- F. Remove temporary protective coverings.

3.2 PROTECTION AND CLEANING

- A. Protect aluminum surfaces that will abut masonry, concrete, wood or steel from contact by neoprene gaskets, or bituminous paint to prevent galvanic or corrosive action. Protect as recommended by door manufacturer.

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- B. Clean all exposed surfaces and remove any temporary protective coverings. Touch-up finish where required

END OF SECTION

SECTION 08-4243
SLIDING STOREFRONT DOORS (ICU/CCU)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manual sliding door systems, 3 panel telescoping, for ICU/CCU installations of aluminum and glass construction.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Provide manual sliding doors produced by a single manufacturer with not less than 10 years successful experience in the fabrication of doors of the type and quality required.
- B. Installer: By an authorized representative of the sliding door manufacturer and with not less than 3 years experience in the installation and service of sliding door assemblies.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Shop Drawings: Clearly indicate the following:
 - 1. Elevations of sliding door system including conformance to NFPA 101 requirements.
 - 2. Method of anchoring door frames to structure.
 - 3. Details at floor, ceiling and side walls.
 - 4. Type of glass and glazing beads.
 - 5. Types of materials and components.
- C. Samples: Submit two samples, 6" long illustrating door and frame finish.
- D. Manufacturer's Product Data: Indicating full compliance with requirements of this section, including installation instructions.
- E. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels and in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUAL SLIDING DOORS (TRACKLESS TYPE)

- A. Manufacturer Stanley Access Technologies, www.stanleyaccess.com
 - 1. Substitutions: The following manufacturers are acceptable: Products of other manufacturers may be submitted for review in accordance with Section 01-2513
 - a. Beasam Inc., www.besam.com
 - b. Horton Automatics, www.hortondoors.com
- B. Type: Telescoping four panel, sliding door system complete with sliding doors, sidelights and track of aluminum and glass construction.
 - 1. Type: 7500 TL Series without track and with full-breakaway of all panels.
 - 2. Locks: Cylinder type, keyed two sides.
 - 3. Size: As scheduled.
 - 4. Configuration: As shown on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Verify that existing conditions are ready to start sliding door work.
 - 2. Beginning door work means acceptance of existing conditions.
- B. Install sliding door system in accordance with approved shop drawings and manufacturer's published recommendations.
 - 1. Door assemblies shall be installed plumb, level and free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

3.2 PROTECTION, CLEANING AND ADJUSTING

- A. Protect aluminum surfaces that will abut masonry, concrete, wood or steel from contact by neoprene gaskets, or bituminous paint to prevent galvanic or corrosive action. Protect as recommended by door manufacturer.
- B. Clean all aluminum surfaces in accordance with door manufacturer's recommendations.
- C. Adjust doors for optimum operating condition and safety.

END OF SECTION

SECTION 08-4313
ALUMINUM FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Swing-door entrances and framing system including subsills of aluminum and glass construction.
- B. Storefront window systems.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Clearly describe:
 - a. Elevations of aluminum/glass door and framing system.
 - b. Sash systems, details and method of anchorage to openings.
 - c. Details of construction including subsills. Method of assembling frames and subsills.
 - d. Locations and installation of hardware.
 - e. Size, shape and thickness of doors and framing materials.
 - f. Joints and connections, and details of joining with other work.
 - g. Hardware types, styles and hardware finishes.
 - h. Type and mil thickness of finish for exposed aluminum surfaces.
 - i. Type and thickness of finish for concealed accessories.
 - 2. Manufacturer's Product Data: Indicating all technical information which specifies full compliance with requirements of this Section, including installation instructions.
 - 3. Samples: Of each type of finish specified applied to minimum size 2" x 2" aluminum samples representative of the actual finish.
 - 4. Written Certification: From systems manufacturer certifying that the installer meets qualification requirements specified under Quality Assurance in this Section.
 - 5. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals.
 - 1. Warranty: As specified elsewhere within this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Manufactured as a system by one manufacturer with a single source responsibility and a minimum of five years successful experience.
- B. Installer: The entrance/framing system shall be installed exclusively by a firm certified in writing by entrance/framing system manufacturer.
 - 1. The firm shall specialize in this type of work and be able to demonstrate in writing a minimum of five years of successful experience in the installation of type of system specified in this Section.

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1.4 JOB MOCK-UP

- A. Mock-Up Panel: Before work in this section is started, provide exterior mock-up for Owner and Architect review and approval of exterior finish elements, materials and construction manner. Comply with provisions of Section 01-3323.

1.5 PRE-INSTALLATION CONFERENCE

- A. Prior to starting roofing and exterior envelope work, the General Contractor shall set up a job site meeting to comply with provisions of Section 01-3119 for the "Envelope and Roofing Pre-Installation Conference".

1.6 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

1.7 WARRANTY

- A. Contractor shall furnish a written certificate guaranteeing the necessary repairs of faulty materials and workmanship to maintain the entrance/framing system in a watertight and airtight condition for a period of two years from date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Provide products manufactured Kawneer Company, www.kawneer.com
- B. Substitutions: The following manufacturers are acceptable. Other manufacturers are acceptable for evaluation only after compliance with substitution requirements specified in Section 01-2513.
 - 1. Tubelite, Inc., www.tubeliteinc.com
 - 2. U.S. Aluminum Company, www.usalum.com
 - 3. Vistawall Architectural Products, www.vistawall.com

2.2 SYSTEM REQUIREMENTS

- A. Comply with ADA Guidelines and governing accessibility codes.

2.3 SINGLE-GLAZED SYSTEM

- A. Swing Doors: Aluminum/glass construction, 1/4" glazing.
 - 1. Type: Kawneer "500 Wide Stile", 5" vertical stiles.
- B. Framing System: Aluminum/"Trifab II" glass construction, 1/4" glazing.
 - 1. Type: Kawneer "Trifab II 450", 1-3/4" x 4-1/2" members, flush glazing.

2.4 DOUBLE-GLAZED SYSTEM

- A. Framing System: Aluminum/glass construction, 1" glazing.

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1. Thermal Type: Kawneer "451T Flush Glazed", 2" x 4-1/2" members, complete with thermal barrier consisting of a dual purpose exterior gasket for eliminating metal to metal contact between exterior and interior of frame. Glazing gaskets shall be EPDM elastomeric extrusions.

- B. Mullions: 2" horizontals and 4" horizontals.

2.5 HARDWARE

- A. General: Provide door manufacturer's standard heavy-duty hardware required for complete operation and watertight installations including the following items. See Section 08-7100 for explanation of door function.
- B. Pivots: Offset type (top, intermediate and bottom) required. Pivots shall be tamper-proof when doors are locked.
- C. Locks: See Hardware Schedule in Section 08-7100.
- D. Manufacturers Standard Hardware as needed to provide functions as described in 08-7100 and provide weather tight installation.
 1. Closer: Surface mounted
 - a. Door Holder: Built into closer.
 2. Exit Devices: Rim panics.
 3. Push/Pulls: 1" wide bars with returns 9" o.c.
 4. Pushes or Pulls: 1" wide bars with returns 9" o.c.
 5. Threshold: Type for offset pivot and overhead closers, extruded aluminum, mill finish.
 6. Weatherstripping: Built in gaskets
 7. Bottom Rail Sweep: To be installed on exterior doors.
 8. Drips: To be installed on exterior doors.

2.6 FINISH

- A. Paint Coating: Kawneer's "Fluoropon" coating meeting or exceeding AAMA 2605.2. Apply to exterior and interior exposed surfaces.
 1. Color: To be selected by Architect from manufacturers premium options.

2.7 MATERIALS AND COMPONENTS

- A. Glass: As specified in Section 08-8100.
- B. Extrusions: 6063-T5 alloy and temper (ASTM B221 alloy G.S. 10A-T5).
- C. Exposed Fasteners: Stainless steel in accordance with ASTM B633.
- D. Perimeter Anchors: Aluminum or steel properly isolated from aluminum.
- E. Glazing Gaskets: Of type specified with doors.
- F. Sealants and Calking: Of type specified in Section 07-9200.
- G. Subsills:
 1. Fabricate to shapes shown of not less than 2mm (0.080 inch) thick extruded aluminum.

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2. One piece full length of opening if practical, with concealed anchors.
 3. If not practical to use one piece, provide 6" long back-up plate of same material, thickness and shape as sill member. Provide for expansion and contraction. Line with expansion joints in window mullions.
 4. Sills turned up back edge not less than 12mm (1/2 inch). Front edge provided with drip.
 5. Do not bridge thermal breaks.
 6. Refer to drawings for details.
- H. Filler Plates: Manufacturer's standard aluminum filler plates (solid backing) are required for attachment at head and jamb members of all glazed framing systems.

2.8 FABRICATION AND PERFORMANCE

- A. General:
1. Aluminum Doors and Frames: Shall be fabricated to allow for clearances and shim spacing around perimeter of assemblies to enable installation. Provide for thermal movement.
 2. Anchorage Devices: Required to securely and rigidly fit door and frame assemblies in place.
 3. Joints and Corners: Shall be flush, hair line, weatherstripped and accurately fitted together.
 4. Condensation Drains: Required within frame construction to drain moisture to exterior.
 5. Provisions for hardware is required, complete with internal reinforcing.
 6. Bituminous Paint: One coat is required on concealed aluminum surfaces in contact with cementitious or dissimilar materials.
 7. Protective Coating: Aluminum finishes shall be shipped from manufacturer with a protective coating specifically for protection of finish during construction; removable after completion of work.
 8. Concealed Steel Items: Primed with zinc dust-zinc oxide primer for galvanized surfaces.
 9. Sub Sills: Fabricated to fit profile of sill framing members; allow for shim spacing. Provide for thermal movement.
- B. Fabrication of Doors:
1. Basic Door Sections: 1-3/4" thick, door size to meet design requirements. Major portions of door stile and rail extrusions shall be .125" nominal thickness.
 2. Door Glazing Moldings: Of type specifically designed for door type specified. Exposed screws shall not be used to secure glazing stops in place. Exterior stops shall be set with tamper-resistant clips.
 3. Door Corner Construction: Shall consist of both sigma deep penetration welds and mechanical fastening.
 4. Entrance Doors: Shall be weatherstripped at jambs, top rail and meeting stiles.
- C. Performance Requirements for Framing System:
1. Air Infiltration: Shall be tested in accordance with ASTM E283. Infiltration shall not exceed .06 CFM per square foot of fixed area.
 2. Water Infiltration: Shall be tested in accordance with ASTM E331. Water shall not penetrate at a test pressure of 6.24 P.S.F. (300 Pa).
 3. Structural Performance: Shall be based on maximum deflection of 1/175 of the span and allowable stress with a safety factor 1.65.
 4. Wind Load Requirements (For Exterior Installation in 90 mile/hour zones): Entrance/aluminum framing system shall perform to these criteria under the

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windload of 25 lbs as noted on structural drawings. Provide miscellaneous structural steel items required to meet design requirements is the work of this Section.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Verify that existing conditions are ready to start the work of this Section.
 - 2. Beginning of work means acceptance of existing conditions.
- B. Install framing system, doors and hardware in accordance with approved shop drawings and manufacturer's published recommendations.
- C. Assemblies shall be installed plumb, level and free of warp or twist.
 - 1. Maintain dimensional tolerances and alignment with adjacent work.
 - 2. Install batt insulation in shim spaces around perimeter of frame assemblies, to maintain continuity of thermal barrier.
 - 3. Set thresholds in solid bed of mastic.
 - 4. Set subsill in bed of mastic with provisions for sealant and shims.
- D. Coordinate glass and glazing work with Section 08-8100.
- E. Adjustment: After repeated operation of completed installation, re-adjust door operators and other hardware for optimum condition and safety.
- F. Sealant Work: Perform in accordance with Section 07-9200.

3.2 CLEANING

- A. Remove protective material from prefinished aluminum surfaces and clean in accordance with manufacturer's instructions.
- B. Remove excessive sealant using a method recommended by sealant manufacturer.

END OF SECTION

SECTION 08-7113
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Energy powered door operators designed for swinging doors and activated by wall mounted pushbutton switch of the following type.
 - 1. High-energy along with safety devices.
- B. Coordinate door hardware requirements with Section 08-7100.
- C. Coordinate electrical requirements with Division 26.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings:
 - a. Indicate location of door operator and accessories.
 - b. Installation and electrical requirements.
 - 2. Product Data: Indicating all information which specifies full compliance with requirements of this section, including installation instructions.
 - 3. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals.
 - 1. Warranty: As specified elsewhere within this section.
 - 2. Maintenance Data: Describing maintenance instructions for type of operator and controls.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in the manufacturer of low energy powered door operators similar to that specified with a minimum five years documented experience.
- B. Installer: An authorized representative of the low energy powered door operator manufacturer and with not less than 3 years experience in the installation and service of door controls similar to that specified.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels and in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

1.5 WARRANTY

- A. Warranty: Manufacturer's one-year written warranty against defect in materials and workmanship from the date of installation.

PART 2 - PRODUCTS

2.1 DOOR OPERATORS

- A. Manufacturer: Provide products manufactured by Stanley Access Technologies, www.stanleyaccesstechnologies.com.
- B. Substitutions: Products of the following manufacturers are acceptable. Products of other manufacturers may be submitted for review in accordance with Section 01-2513.
 - 1. Horton Automatics, www.hortondoors.com
 - 2. Besam is a subsidiary of ASSA ABLOY, www.besam.com
- C. Type: Extra heavy duty full-energy operator, Magic-Force, complying with ANSI A156.10 and U.L. Listed for electric door operators.
 - 1. Safety Devices: Provide as required by ANSI A156.10.
- D. Operations:
 - 1. Construction: Self-contained electromechanical, shock-mounted and concealed in extruded aluminum case with access panel. Operator shall be readily convertible to any band required.
 - 2. Opening Force: Accomplished by a 1/4 HP DC motor, gear drive, ball screw actuator, rack and pinion permanent magnet motor working through reduction gears to the out port shaft, gear train bearings shall be sealed ball bearing types.
 - 3. Close Speed Control: Accomplished by dynamic braking of the motor; fully adjustable.
 - 4. Manual Closing: Operator shall act as a manual closer when power is off or when the master control unit is removed; an on/off reset switch shall be supplied.
 - 5. Adjustable Time Delay: The master control unit shall incorporate an adjustable time delay of 2 to 30 seconds.
 - 6. Motor Protection Circuit: Provided by a locked door motor protection circuit that shuts off current if applied when the door is inadvertently locked or otherwise prevented from opening; power to the motor is restored when the on/off reset switch is turned on.
 - 7. Manual/Automatic Control: Manual operation when pushed open, automatic operation when actuated by pushbutton switch.
 - 8. Automatic Controls: By pushbutton switch.
 - 9. Control Switch: Provide a CB15-2 marked with the international handicap insignia, on each side of the opening where indicated on the drawings.
 - 10. Finish: Manufacturers standard caustic etch and anodic oxide treatment conforming to aluminum association standard AA-M12C22A31.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Inspect adjacent and affected work. Starting work of this section means acceptance of site conditions.
- B. Install electronic door controls in accordance with shop drawings and manufacturer's published instructions.
- C. Coordinate installation of components including controls with related and adjacent work and to comply with ADA and ANSI.

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- D. Adjustment: After repeated operation of completed installation, re-adjust door operators and controls for optimum condition and safety and compliance with ADA and governing codes.

3.2 CLEANING

- A. Clean all surfaces in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 08-8100
GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Glass, and glazing for Sections referencing this Section for Products and Installation.
- B. Leaded glass specified in Section 13-4900.
- C. Magnetic marker board.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Provide materials produced by a single manufacturer or fabricator with a minimum of ten years experience.
- B. Installer: Firm with not less than three years successful experience in installation of products specified.
- C. Labels: Each piece of glass shall bear manufacturer's label showing strength, grade thickness, type and quality.
 - 1. All fire windows and vision panels newly installed in an existing facility or a new one under construction must be labeled as to their fire rating, and the label must be visible after installation.
- D. When glass is not cut to size by manufacturer and is furnished unlabeled from local stock, submit affidavit stating quality, thickness, type and manufacturer of glass furnished.
- E. Safety Glazing Standard: Comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials including tempered glass, tempered safety glass, laminated safety glass, etc.
- F. Polished Wire Glass: Provide polished wire glass tested per ANSI Z97.1 and ASTM E163 (UL 9), labeled and listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.
- G. Insulating Glass Certification Program: Provide certification label of Insulating Glass Certification Council (IGCC).

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data on Glass Types: Physical, structural, environmental characteristics, size limitations, special hardening or installation requirements.
 - 2. Samples: 8"x8" of each type of glass specified.
 - 3. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants.

- B. Manufacturer's Written Guarantee: For insulating glass as specified in this Section.
- C. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect glass and glazing materials to comply with manufacturer's directions and to prevent edge damage from effects of moisture.

1.5 WARRANTY

- A. Insulating Glass: Submit insulating glass manufacturer's 10-year written warranty which guarantees the sealed glass units from seal failure, interpane dusting or misting, internal condensation at temperatures of -20F. and other evidence of hermetic seal failure.
 - 1. Written warranty shall also guarantee the quality of sealed glass units meets or exceeds SIGMA "Specification for Sealed Insulating Glass Units."
 - 2. Warranty period of 10 years shall begin when seal date is permanently imprinted on sealed glass units, but the sealed glass units shall be guaranteed for not less than 9 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/FABRICATORS

- A. Products of the following manufacturers are acceptable:
 - 1. Glazing
 - a. Arch Aluminum
 - b. AFG Industries, Inc.
 - c. Guardian
 - d. PPG
 - 2. Insulated Glass Units
 - a. Oldcastle Glass, www.oldcastleglass.com
 - b. Interpane
 - c. Viracon Inc.
- B. Substitutions: Products of other manufacturers are acceptable only after compliance with Section 01-2513.

2.2 INSULATING GLASS UNITS

- A. Type: Hermetically sealed units made of two glass units separated with 1/2" air space, manufactured to meet or exceed the quality standards established by SIGMA, IGCC, ASTM C1036, ASTM E773, ASTM E774 and ANSI Z97.1.
 - 1. Inside Glass: 1/4" clear heat treated float glass, coated on third surface. Glass tempered in locations indicated on drawings.
 - 2. Inside Glass Coating: Low-E (Sputtered).
 - 3. Outside Glass: 1/4" heat treated tinted glass, tempered in locations indicated on drawings.
 - 4. Overall Summer U-Value: .35 or lower.

5. Overall Winter U-Value: .34 or lower.
6. Overall Shading Co-efficient: .52 or lower.
7. Overall Thickness: 1"
8. Exterior Appearance: Bronze
9. Use: For exterior window storefronts and entrances

2.3 LAMINATED GLASS

- A. Clear Laminated: Glass Two lights of ¼" clear, heat-strengthened glass with a 0.060" clear polyvinyl butyl interlayer sandwiched between the glasses to form monolithic panels, 9/16" thick, manufactured to meet or exceed quality standards established by ASTM E1172, CPSC 16, and ANSI Z97.1.
 1. Use: Door and window in Drug Room.

2.4 WIRE GLASS

- A. Wire Glass: Manufactured to meet or exceed quality standards established by ASTM C1036 and ANSI Z97.1 and, approved by Underwriters Laboratories as a fire-retardant material. 1/4" clear, Type II, Class 1, Quality q3, Form 1, Mesh M1 square of polished stainless steel wires, with safety film, I-w Superlite, manufactured by Safti First, www.safti.com
 1. Use: Rated doors with ratings as indicated on drawings.

2.5 FLOAT GLASS

- A. Float (Inside Clear): Manufactured to meet or exceed quality standards established by ASTM C1036, Type I, Class 1, Quality q3, CPSC 16 and ANSI Z97.1.
 1. Thickness/Type: 1/4", clear polished glass.
 2. Provide fully tempered glass where noted on drawings.
 3. Use: Interior doors & windows.

2.6 TEMPERED GLASS

- A. Kind FT (fully tempered) Safety Glass, manufactured to meet or exceed quality standards established by ASTM C1048, CPSC 16, and ANSI Z97.
 1. Thickness/Color: 1/4" tempered safety glass, clear
 2. Use: For interior tempered glazing as indicated in drawings

2.7 MAGNETIC GLASS MARKER BOARDS

- A. Manufacturer: Goldray Industries Ltd.
 1. Other manufacturers are acceptable after complying with the requirements listed below and following substitution procedures outlined in Section 01-2513.
- B. Properties:
 1. Meets ASTM C1036 - Standard specifications for Flat Glass and ASTM C1048
 2. Standard Specifications for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass
 3. Magnetic Glass: Provide compatible rare earth magnets.
 4. Thickness: 1/4"

5. Edging: Polished
6. Annealed glazing required.
7. Film Thickness: 12-25 microns (ASTM D 1212 & ASTM D 823)
8. Average Opacity: Fully Opaque
9. Color Tolerance: 1 delta E (CIE LAB @ D65 10 degrees) (ASTM D 2244)
10. Durability: Passes ASTM D3359
11. Refer to casework drawings for locations and sizes.

2.8 GLAZING MATERIALS

- A. Glazing Tape: Preformed butyl type; NAAMM #SS-1B-68, 10-15 Shore A durometer hardness; coiled on release paper; black color.
- B. Setting Blocks: Neoprene; 70-90 durometer hardness; 4 inch long x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- C. Spacer Shims: Neoprene 50 to 60 Shore A durometer hardness; 3 inch long x one inch of the height of the glazing stop x thickness to suit application, self adhesive on one side.
- D. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 INSTALLATION

- A. In general, glazing work shall be in accordance with procedures in FGJA "Glazing Manual". Glaze in temperature above 40 degrees. Sash shall be clean and dry. Setting blocks shall be at one-fourth points.
- B. Glass shall be cleanly cut, free of edge chips or irregular cleavages, to prevent "built-in" fatigue or stress patterns.
- C. Allow edge clearance for expansion, deflection and racking. Install without binding, warping or straining.

- D. Where glazing beads are provided, carefully remove and reset to avoid defacing sash, beads, setting screws or doors.

3.4 CLEANING

- A. Immediately remove drippings from finished surfaces.
- B. Remove labels after work is completed.
- C. At completion of work, leave glass in clean and unmarked condition.

3.5 PROTECTION OF INSTALLED GLASS

- A. Mark and identify glass after installation and during construction phase to indicate that opening has been glazed in order to prevent injury to persons who might mistake such areas as unglazed opening.
- B. Use markers to identify glazed openings such as tapes or flags. If soap or cleaning powders are used, such materials shall be guaranteed not to "photograph" to etch glass in such manner as to leave permanent impressions in glass.

END OF SECTION

SECTION 09-2116
GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Coordinate the work of this Section with Section 05-4100- Exterior Load Bearing Wall Framing and Section 09-1643- Gypsum Wall Sheathing.
- B. Gypsum board on metal framing and furring members for interior walls and interior ceiling.
- C. Lead lined gypsum board furnished and specified under Section 13-4900, installed under this Section.
- D. Tile backer board reference in other Sections of these specifications.
- E. Polyethylene vapor retarder.
- F. Sheetrock First Coat specified in Section 09-9100.

1.2 QUALITY ASSURANCE

- A. General: Gypsum board manufactured of synthetic materials containing phosphate slag is not acceptable.
- B. Where gypsum board systems with fire-resistance ratings are indicated or required, comply with detailed drawings and/or in accordance with local and state codes if they are more stringent to produce a satisfactory fire-rated system.
- C. Employ only qualified wallboard finishers with a minimum of three years experience for finishing the gypsum board.
- D. Notify Local inspecting authorities and Architect 7 days prior to beginning the installation of gypsum board.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Manufacturer's Product Data: Indicating all technical information which specifies full compliance with requirements of this Section, including installation instructions.
- C. Submit plans or narrative of proposed locations of control joints.
- D. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site bearing manufacturer's labels.
 - 1. Handle materials in a way which will prevent damage. Comply with Section 01-6500.
- B. Store materials inside, under cover, in a dry place.
 - 1. Stack flat, off floor, on boards.
 - 2. Support gypsum boards to prevent sagging.

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3. Store adhesives and joint material in a warm, dry place in accordance with manufacturer's printed instructions.
4. Overloading floors is prohibited.
5. Comply with Section 01-6600.

1.5 JOB CONDITIONS

- A. Maintain medium constant temperature (minimum 55°F) in areas where work is performed before, during, and after gypsum board and joint treatment applications.
- B. Provide ventilation during and following application of adhesives and joint treatment.
- C. Protect system from drying too fast.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

- A. Gypsum Board Types/USG "SHEETROCK" Brand, manufactured by USG Corporation, www.usg.com
 1. Fire-Rated: Type "X", tapered edges, 5/8" thick.
 2. Water-Resistant: Type "X", WR, tapered edges, 5/8" thick.
 3. Mold Resistant: USG Sheetrock brand Type "X" Mold Tough, 5/8" thick.
 4. Tile Backer Board: Dens-Shield Tile Backer, Georgia-Pacific, 5/8" thick. Acceptable Alternate: Durock Interior Tile Backer Board, 1/2" thick.
 5. Lead-Lined: Specified in Section 13-4900/Radiation Protection.
 6. Abuse-Resistant Board: Fiberrock, USG, 5/8" thick.
 7. Sound Attenuation Drywall: Quietrock, www.quietsolution.com
- B. Substitutions: The following manufacturers are acceptable. Other manufacturers are acceptable for evaluation only after compliance with Section 01-2513.
 1. National Gypsum Company (Gold Bond), www.nationalgypsum.com
 2. Temple Inland, www.templeinland.com

2.2 ACCESSORIES

- A. Screws: USG, drywall Type S, self-drilling, Type S-12 self-tapping, Bugle Head and Pan Head screws for use with power driven screw drivers.
- B. Laminating Adhesive: Of type recommended by gypsum board manufacturer for double-layer application and column fireproofing.
- C. Caulking: USG Sheetrock "Acoustical Sealant" for sound-rated partitions and ceiling systems and sealing exterior walls to reduce infiltration.
- D. Joint Treatment Compounds (Asbestos-Free):
 1. Adhesive Joint Treatment: USG "Perf-A-Tape".
 2. Sheetrock brand joint tape for mold-resistant board.
 3. Joint Compound: USG "Ready Mixed Compound - All Purpose" for Type "X" gypsum board.
 4. Joint compound: USG sheetrock Setting - Type joint compound for mold-resistant board.
- E. Trim:
 1. Outside Corner Trim: USG Sheetrock Brand Paper Faced Metal Outside Corner (Micro Bead).
 2. Control Joint: USG Zinc Control Joint No. 093.
 3. Steel Casing: USG Sheetrock Brand Paper Faced Metal "L" Shaped Tape on Trim (B4 Series).

4. Sheetrock J-Stop: Sheetrock Brand Paper Faced Metal “J” Shaped Tape on Trim (B9).
 5. Reveal: USG Sheetrock Brand Paper Faced Metal, 1” tall by 5/8” deep.
- F. Polyethylene Vapor Retarder: 6.0 mils, 0.23 perms, ASTM D4397.
1. Surface Burning (ASTM E84) : Flamespread 25, smoke developed 450.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which drywall construction attaches or abuts for compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 CEILING BOARD INSTALLATION

- A. General:
1. Coordinate gypsum board work with ceiling framing work/ Section 09-2226 and details.
 2. Ceiling framing system shall be plumb and true before starting gypsum board work. Do NOT start work until deficiencies have been corrected.
 3. Verify that existing conditions are ready to receive the gypsum ceiling board work.
 4. Beginning of gypsum ceiling board work means acceptance of existing conditions.
- B. Install ceiling gypsum board before board is installed on walls unless walls are required to extend above ceiling.
1. Comply with manufacturer's printed instructions for installing.
- C. Install sheet metal substrate in spaces indicated on drawings with self-drilling screws spaced 12" max. on centers.

3.3 WALLBOARD INSTALLATION

- A. General:
1. Coordinate gypsum wallboard work with metal wall framing/ Section 09-2216 and details.
 2. Install high priority walls first and then the lessor priority walls as required.
 3. Install sheet metal substrate to wall in spaces indicated on drawings with self-drilling, self-tapping screws spaced 12" max. on centers.
- B. Attach all gypsum board with screws 3/8" to 1/2" from edges and space at no more than 8" on center at edges and 12" in the field. Drive screws so head rests in slight dimple without cutting face paper or fracturing core.
- C. Supply gypsum board in practical lengths to minimize end to end butt joints.
- D. All drywall must be installed vertically avoiding end to end or end to tapered edges whenever possible.
- E. Bring boards into contact but do not force into place; fit neatly and carefully.
- F. Drywall at tub or shower locations may be installed horizontally to avoid cut ends at tops of tubs or shower bases.
- G. Stagger edge joints on opposite side of partition so they occur on different framing members.
- H. Proceed with attachment from board center toward ends and edges.

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- I. Make all cuts neatly.
- J. At Floor Slab:
 - 1. For Rated and Non-Rated Walls: Leave 1/4" maximum space between floor slab and bottom edge of gypsum board.
 - 2. Sound Insulated Walls: Set gypsum board in continuous bed of acoustical sealant, at floor and vertical intersection.
- K. At Exterior Walls:
 - 1. Where penetrations are necessary in gypsum board wall completely seal and tape to maintain integrity of wall.
- L. At Control Joints:
 - 1. Where double studs are installed to create control joints, leave 1/2" separation between gypsum boards for installation of control joint units.
 - 2. For Fire-Rated Walls, Rated Smoke Walls, and Non-Rated Smoke Tight Walls: Completely fill the 1/2" control joint space with safing insulation.
 - 3. Install the specified control joints in accordance with manufacturer's published instructions.
- M. At Bottom of Deck:
 - 1. Where wallboard extends to bottom of floor or roof deck install specified deep leg track runner.
 - 2. Install as detailed on drawings and as recommended by manufacturer.
- N. Water-Resistant Gypsum Board:
 - 1. Install water resistant gypsum board immediately adjacent to all tubs, showers, janitor sinks, clinical sinks, scrub sinks, soiled utility sinks, and sterilizers.
 - 2. When ceramic tile and/or quarry tile are scheduled in the following areas, install backerboard behind tile:
 - a. All toilets and baths.
 - b. Shower walls.
 - 3. Treat cuts, edges of utility holes, fastener beads, joints and intersections with thinned tile adhesive.
 - 4. For Fire-Rated and Smoke Walls: Install fire-rated water-resistant gypsum board over fire-rated gypsum board, if required to achieve rating.
 - 5. Do not install water resistant gypsum board on ceiling. Use regular 5/8" Type "X" gypsum board.
 - 6. Where backerboard meets the surrounding gypsum board, fill the gap with silicone calk to prevent moisture from wicking into the gypsum. Avoid getting calk on the board's face.
- O. Abuse-Resistant Gypsum Panels:
 - 1. Install abuse-resistant gypsum panels to deck and on the opposite or outer perimeter walls around Secure Room.
 - 2. Attach to walls using screws specified under 2.2.A
- P. Mold-Resistant Gypsum Panels(Fire Rated):
 - 1. Install mold-resistant gypsum panels to the interior face of all exterior metal studs.
 - 2. Install mold-resistant gypsum panels instead of type "X" gypsum board when installation occurs before the building is completely dried in.
 - 3. Install mold-resistant gypsum panels on walls in the operation rooms.
 - 4. Attach to wall using applicable screws specified within this section.
 - 4. Install as indicated under Wall Installation paragraph within this specification section.
- Q. Double-Layer Construction:
 - 1. Screw first layer to studs and runners with specified screws. Space screws at studs 8 inches staggered c.c. at joint and 12" c.c. at intermediate studs.

2. For Non-Rated Construction: Install first layer of wallboard with long edges of board vertical and install second layer in accordance with manufacturer's recommendations.
 3. For Fire-Rated Construction: Use either one layer of Ultracode Core, 3/4" thick or install second layer of fire-rated, Type "X" wallboard with joints offset from those of first layer. Screw attach second layer in accordance with manufacturer's printed instructions.
 4. In fire-rated walls where items are built into the walls (such as fire extinguishers), the opening in wall shall be "boxed" in or enclosed with same wall construction and thickness of gypsum board. See Details in the Drawings.
- R. Sound Attenuation Drywall: Install following manufacturer's written instructions and in locations indicated on drawings.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Attach vapor retarder as noted on drawings.
- B. Extend vapor retarder to extremities of areas to be protected. Secure in place with adhesive or mechanical fasteners. Extend vapor retarder to cover voids in insulated substrates, including those which have been stuffed with loose fiber-type insulation.
- C. Seal joints by lapping not less than 2 wall studs and fasten at top, end and bottom edges, at perimeter of wall openings and at lap joints; space fasteners 15" o.c.
- D. Seal overlapping joints in vapor retarders with adhesives per manufacturer's directions. Seal butt joints and fastener penetrations with tape of type recommended by manufacturer. Locate all joints over framing members of other solid substrates.
- E. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with tape of type recommended by vapor retarder manufacturer to create an air-tight seal.
- F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with tape or another layer of vapor retarder.

3.5 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. Install corner beads at external corners.
- B. Install metal edge trim whenever edge of gypsum board, terminates against masonry or would otherwise be exposed or semi-exposed. Provide 1/4" minimum space between edge trim and masonry and calk.
- C. Install vinyl trim where gypsum boards terminate at exterior window frames and where required to reduce sound transmission, replace calking, and provide stress relief at perimeter.
- D. When metal trim is used to terminate gypsum board at exterior window frames, provide 1/4" space between trim and window and install insulating tape or waterproof acrylic calk. Do not allow contact of steel drywall trim and aluminum window.
- E. Install control joints at locations indicated or, if not indicated, at spacings and locations required by referenced gypsum board application and finish standard, and approved by the Architect for visual effect. In corridors, align control joint with outside edge of door frame.

3.6 GYPSUM BOARD FINISHING

<u>LEVEL</u>	<u>DESCRIPTION</u>	<u>USE</u>
0.	No taping, finishing, or accessories required	For temporary construction.
1.	All joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Where fire rating is required, comply with local governing code requirements.	Plenum areas above ceilings, in attics, in areas where the assembly would generally be concealed, in areas not normally open to public view. Some degree of sound and smoke control is provided; in some areas referred to as "fire-taping," where fire resistance rating is required, details must be in accordance with fire tests of assemblies that have met the fire rating requirement.
2.	All joints and interior angles shall have tape embedded in joint compound and one separate coat of joint compound applied over all joints, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.	Where W/R gypsum backing board is used as a substrate for tile.
3.	All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. All joint compound shall be smooth and free of tool marks and ridges. It is recommended that the prepared surface be coated with a primer/sealer prior to the application of final finishes.	In areas which are to receive heavy or medium texture finishes before final painting, or where heavy grade wallcoverings are to be applied.
4.	Joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. All joint compound shall be smooth and free off tool marks and ridges. Surfaces shall be coated with a primer/sealer prior to the	In areas where light textures or wallcoverings are specified do not use unbacked vinyl wallcoverings over this level of finish.

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<u>LEVEL</u>	<u>DESCRIPTION</u>	<u>USE</u>
	application of final finishes.	
5.	All joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.	For walls in Public Waiting Areas, Public Corridors and Operating Rooms.
3.7	LEAD-LINED GYPSUM BOARD	
A.	Lay out the pattern to determine locations of vertical joints.	
B.	Lead Strips: <ol style="list-style-type: none">1. Install lead strips on studs, where vertical joints will occur, with contact cement.2. At Corners: Form lead so that lead strips overlap corners and extend at least 1/2" each way.	
C.	Lead-lined Board: <ol style="list-style-type: none">1. Center vertical edges of board over lead strips on studs, and screw to all studs.2. Set edges of board on lead strips in contact cement, then screw board in place.1. Screw Spacings: 8" o.c. at board edges, 12" o.c. in board field.	
D.	Lead Discs: <ol style="list-style-type: none">1. After lead-lined board is properly screwed in place, cover screw heads with lead discs set in place with solid application of contact cement.	

END OF SECTION

SECTION 09-2216
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Non-load bearing metal wall framing for interior steel stud wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners and accessories for the screw attachment of gypsum board or other building boards, to comply with local and governing seismic requirements.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Indicating full compliance with requirements of this Section, including installation instructions.
 - 2. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.3 QUALITY ASSURANCE

- A. Perform metal stud work in accordance with stud manufacturer's published installation instructions.
- B. To meet fire-ratings indicated, comply with Underwriters' Laboratories (UL) or other applicable testing laboratory.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in accordance with manufacturer's recommendations bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.

1.5 COORDINATION

- A. Verify that installation of metal stud walls and partitions is coordinated with locations and sizes of plumbing cleanouts and similar piping, fire extinguisher and electrical panels, and other built-in items occurring within the wall.
 - 1. Thickness of gypsum board/stud wall shall be adequate to completely enclose piping and cabinets and to maintain integrity of rated installations.

1.6 SEISMIC REQUIREMENTS

- A. Comply with applicable tables, charts, Cp values, importance factors, and other requirements.

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- B. For attachments, welds, bolts, screws and other required connections, comply with applicable codes and standards.
- C. Refer to Architectural and Structural Drawings for special seismic requirements.
- D. Use construction methods required to meet seismic requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are acceptable:
 - 1. ClarkWestern, www.clarkwestern.com
 - 2. Consolidated Systems, Inc. (CSI), www.csisteel.com
 - 3. Dietrich Industries, www.dietrichmetalframing.com
- B. Products by other manufacturers are acceptable for evaluation when in compliance with the technical requirements of this Specification Section; when equal in properties and weight to the products listed above; and when submitted for evaluation in accordance with the requirements of Section 01-2513.

2.2 FRAMING MEMBERS

- A. Protective Coating:
 - 1. Galvanize steel studs, runners (track), rigid (hat Section), furring channels, and resilient furring channels, ASTM A123, G-60 minimum.
- B. Interior Studs. Cee-shaped, punched web steel studs, hot-dipped galvanized finish (ASTM A525) complying with ASTM C645 of the following sizes, gages, and structural properties. Refer to drawings for requirements.
 - 1. 3-5/8", 20 gage (.0329" wall thickness), Moment of Inertia about major axis 0.414, Section Modulus 0.213.
- C. Runners (Track):
 - 1. Type: Sized for studs used and of the same gage. Galvanized finish shall conform to the requirements of ASTM A525.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. If retaining "Single Long-Leg Runner System" Subparagraph below, indicate type of bridging required on Drawings or by inserts. Strap and 1-1/2-inch (38-mm) cold-rolled channel are commonly used.
 - 2. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
- E. Diagonal Wall Braces Above Ceilings:
 - 1. Type: Metal Studs complete with galvanized steel angles for attachment to underside of metal deck or structure above.
 - a. Refer to drawings for details.
- F. Metal Angles:

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1. Type: 24 gage galvanized steel, 1-3/8" x 7/8", 2-1/2" x 2-1/2" size.

G. Sealants for Installation Under Interior Stud Tracks:

1. Pecora BA-98-Acoustical, one part butyl compound. Use in areas to prevent migration of harmful fluids under track.
2. Pecora Acoustical Latex AI5-919 sealant. Use in areas to reduce sound transmission under tracks.

2.3 METAL FRAMING FOR SHAFT WALL

A. Type For Rated Shaft-Walls: Comply with requirements of USG Cavity Shaft-Wall Systems "System Folder SA-926".

B. Studs: USG C-H Studs or E-Studs

1. Stud Sizes: Of lengths to fit required conditions:
 - a. For Other Vertical Shaft Enclosures:
 - 1) First Floor: 4, 20gage C-H (C-T) and E studs.

C. Runners: USG J-Runners, designation in accordance with stud size, hot-dip galvanized steel.

D. Metal Angles: 1-3/8" x 7/8"

E. Jamb Struts: USG 20 gage 4" Steel Jamb Struts with 3 inch and 1 inch leg length for hoistway elevator door framing, hot-dip galvanized.

F. Maximum Deflection: L/240, except where more stringent requirements are enforced by state or local regulatory agencies.

1. L/360 is required to accommodate marble, ceramic tile, plaster and other similar finishes.

2.4 FASTENERS

A. For attachment to Masonry and Concrete:

1. Type: Powder-actuated fasteners manufactured by Hilti, No. X-2F32P.8523, meeting the following minimum requirements: Comply with ICBO No. ER-2388.
2. Spacing: Space fasteners in track at .2" from ends and two rows 12" o.c., full length of track.
 - a. Size: 1-1/4" minimum length.
 - b. Diameter: 0.138 diameter.

B. For Attachment to Metal or Wood:

1. Type: Pan-head screws as recommended by fastener manufacturer, self-drilling, self-tapping.

C. Tie Wire and Hanger Wire: Galvanized Soft Annealed Wire, ASTM A641, Class I coating.

1. Gage: Use for wire-tying channels in wall furring, diameter as specified in ASTM C754 or ASTM C841.

PART 3 - EXECUTION

3.1 INSTALLATION INTERIOR WALL FRAMING

- A. General:
 - 1. Do not install wall studs before door frames are set in place, anchored and braced.
 - 2. Wall Stud Spacing: 16" o.c., unless otherwise indicated.
 - 3. Rough-Openings: Construct as specified in this Section.
 - 4. Do not bridge building expansion and control joints with steel framing or furring members.

- B. At Wall-Hung Cabinets and/or Casework:
 - 1. Install 20 gage double studs at 16" o.c. for full width of cabinetwork plus 12 inches on each side of cabinetwork.

- C. For Furr-Downs at Wall-Hung Cabinets and/or Casework, Housing for Ducts and Pipes:
 - 1. Install 20 gage studs at 16" o.c. prior to installation of ceiling grid so that grid angle will abut the vertical portion of furr-down.
 - a. Use braced system for depths of 48" (vertically) and widths to 72".
 - b. Use unbraced system for soffits up to 24" x 24".

- D. For Control Joints:
 - 1. Install double studs 1/2" apart to create control joints.
 - 2. Control Joint Spacings: Not over 30 feet apart.
 - 3. Fill 1/2" control joint spaces between studs with safing insulation.

- E. Walls Which Extend Through Ceilings:
 - 1. Extend wall stud system through acoustical ceilings and elsewhere indicated to the structural support or substrate above the ceiling.
 - 2. For walls up to 15' in height using 20 gage studs install cold-rolled channel stiffeners at mid-points and attach with 3/8" Pan Head Type S screws driven through both flanges of stud and runner. For walls over 15' high install stiffeners at third points and attach with 3/8" Pan Head Type S screws.

- F. Additional Framing:
 - 1. Install additional framing, blocking and bracing at terminations in the work and for support of the following:
 - a. Fixtures and equipment services.
 - b. Toilet accessories and grab bars.
 - c. Wall guards and handrails.
 - d. Furnishings and similar work to comply with details; if not indicated, comply with "Gypsum Construction Handbook".
 - 2. Horizontal metal runner bracing may be used in lieu of wood blocking.
 - a. Horizontal metal runners shall be 4"x18 gage minimum notched to bypass studs.
 - b. Screws: Two 3/8" diameter pan head screws at each stud.

- G. Bracing of Walls Above Ceilings:
 - 1. Where walls extend above ceilings, but not to structure, brace top of walls with diagonal stud braces at approximately 36" o.c.

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2. Attach stud braces to galvanized steel angles secure to bottom side of structure.
 3. Install diagonal bracing at latch side of all door jambs.
- H. Metal Furring Channels on Ceiling or Walls:
1. Spacings: 16 inches o.c.
 2. For horizontal application install first channels 4 inches from floor and ceiling lines.
 3. Attach to substrate with suitable fasteners spaced 16" o.c. in alternate flanges.
 4. To provide space for pipes or ducts install wall furring brackets, 3/4" cold-rolled channels 24" o.c., and furring channels 16" o.c.
- I. Install specified sealant in two beads under ALL interior metal stud tracks according to sealant manufacturer's written instructions. Prepare surface to receive sealant according to manufacturer's requirements.
- J. Walls with Sheet Metal, DUROCK Board or Plywood Backing:
1. Install 20 gage metal studs, 16" o.c.

3.2 INSTALLATION OF TOP RUNNERS

- A. Where Stud Walls Extend to Bottom of Spray Fireproofed Beams:
1. Install 2 inch minimum long "Z" clips required to minimize disruption of spray fireproofing materials.
 2. "Z" clips shall be attached to beams PRIOR to first application of spray fireproofing.
 3. See drawings for "Z" clip spacings.

3.3 ROUGH OPENINGS

- A. Jambs: Double 20 gage studs from floor to structure. Spot-grout at jamb anchors for hollow metal frames by applying joint compound before gypsum board is installed.
- B. Header:
1. For openings up to 4'-0" wide with standard doors; fabricate sill and header Sections from 20 gage runners cut to length approximately 6" longer than rough opening. Slit flanges and bend web to allow flanges to overlap adjacent vertical studs. Securely attach with screws. Install cripple studs at 16" o.c.

3.4 SHAFT-WALL INSTALLATION

- A. General:
1. Coordinate shaft enclosure work with interior wall framing and interior gypsum board/Section 09-2116.
 2. Verify that existing conditions are ready to receive the shaft-wall work.
 3. Beginning of shaft-wall work means acceptance of existing conditions.
- B. For Rated Assemblies:
1. Perform vertical shaft wall in strict compliance with USG Cavity Shaft-Wall "System Folder SA-926", submitted to and reviewed by Architect for this work.
 2. Follow G-P Gypsum recommendations for installation of Dens-Glass Ultra Shaft Liner.
 3. Notify Architect prior to installing gypsum board on exterior side of shaft-wall for his review of shaft-wall construction.

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4. Framing members shall be secured plumb and in a true plane, and shall be complete in accordance with shaft-wall manufacturer's published recommendations.
- C. At Handrails:
1. Where handrails are indicated for direct attachment to shaft-wall, provide not less than 16 gage x 4" wide galvanized steel reinforcement strip, applied parallel to stair stringers, accurately positioned, and secured behind not less than 5/8" gypsum board.
- D. At Expansion Joints:
1. Do not bridge building expansion joints with shaft-wall assembly. Frame both sides of joints with steel studs, pack joint with THERMAFIBER SAFB and apply sealant.

END OF SECTION

SECTION 09-2226
SUSPENSION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ceiling suspension systems for interior gypsum board ceilings.

1.2 QUALITY ASSURANCE

- A. Perform gypsum board ceiling work in accordance with manufacturers published installation instructions.
- B. To meet fire-ratings indicated, comply with Underwriters' Laboratories (UL) or other applicable testing laboratory.
- C. Provide materials manufactured and extracted from locations within 500 miles of project site.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittal.
 - 1. Manufacturer's Product Data: Clearly describing quality of all components and installation instructions.
 - 2. Provide name of city and state where materials specified in this section where manufactured.
 - 3. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in accordance with manufacturer's recommendations bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.

1.5 SEISMIC REQUIREMENTS

- A. Comply with applicable tables, charts, Cp values, importance factors, and other requirements.
- B. Use construction methods required to meet seismic regulatory requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER

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- A. Manufacturer: Provide products manufactured by Stanley Access Technologies, www.stanleyaccesstechnologies.com.
- B. Substitutions: Products of the following manufacturers are acceptable. Products of other manufacturers may be submitted for review in accordance with Section 01-2513.
 - 1. Armstrong, www.hortondoors.com
 - 2. Chicago Metallic, www.chicagometallic.com

2.2 COMPONENTS

- A. General: Commercial quality, cold rolled steel, hot dipped galvanized finish.
- B. Main Tees: Fire-Rated Heavy Duty classification 1-1/2 high x 144 long, integral reversible splice with knurled face.
- C. Cross Members: Fire-Rated members with knurled face.
- D. Cross Tees: 1-1/2 high x 48 long with 1-1/2 wide face. Tees must have quick release cross tee ends to provide positive locking and removability without the need for tools.
- E. Furring Channel: 7/8 high x 48 long with 1-1/2 face.
- F. Accessory Cross Tees: Cross tees must have knurled faces. Cross tees have quick release cross tee ends to provide positive locking and removability without the need for tools.
- G. Gypsum Board panels and drywall accessories are specified in section 09-2116 Gypsum Board Assemblies.

2.3 ACCESSORIES

- A. Provide: Transition Clips, Splice Clips, and expansion joints by USG Corporation.
- B. Suspended Ceiling Framing:
 - 1. Red iron intermediate structure as required to support hanging system from roof structure
 - 2. Hanger Wire: 9 gage, 12 gage galvanized steel wire.
 - 3. Hanger Wire Locations: 4'-0" O.C. maximum in both directions.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Verify that work above ceiling is complete and existing conditions are acceptable.
- B. Coordinate the layout of hanger wires with other work above ceiling.
- C. Beginning ceiling framing work means acceptance of existing conditions.

3.2 INSTALLATION

- A. General:
 - 1. Install ceiling framing independent of walls, columns, and above ceiling work.
 - 2. Installation shall be in accordance with ANSI/ASTM C754 and manufacturer's instructions.
 - 3. Size and space suspension members as recommended by USG Corporation.

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- B. Final ceiling framing installation shall be level and flat with required openings framed and reinforced; ready to receive gypsum board ceilings.

END OF SECTION

SECTION 09-3013
TILING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Interior ceramic tile floor and base finish using the full mortar bed method.
- B. Ceramic wall tile installed on moisture-resistant interior gypsum board walls using adhesive.
- C. Grout
- D. Marble thresholds.

1.2 QUALITY ASSURANCE

- A. Obtain setting, grouting materials, waterproofing membrane, crack isolation membrane, and tile from a single source to provide products of consistent quality in appearance and physical properties.
- B. Installer: Experienced Installer who has successfully completed installations similar in material, design, and extent to that indicated for Project.
- C. Perform the work in accordance with American National Standard Specifications (ANSI) and Tile Council of America (TCA) installation method.
- D. Floor Materials: Floor tile Static Coefficient of friction shall conform to ADA recommendation for slip resistance.
- E. Provide materials manufactured and extracted from locations within 500 miles of project site.
- F. Use adhesives with a VOC content of less than 65 g/L.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Indicating all technical information which specifies full compliance with requirements of this Section.
 - 2. Shop drawings indicating tile patterns and locations and widths of expansion, contraction, control, and isolation joints in substrates and tile surfaces.
 - 3. Tile Samples: Manufacturer's color charts consisting of actual tiles showing full range of colors, textures, and patterns available for Architect's review.
 - 4. Grout Samples: Manufacturer's samples indicating full range of colors available for Architect's review and selection.
 - 5. Master Grade Certificate: Furnish for each shipment, type, and composition of tile signed by tile manufacturer and installer.

6. Certificates of Compliance: Tile manufacturer shall furnish Certificates of Compliance stating conformance with all requirements of American National Standards Institute Specification ANSI A137.1, most current edition.
7. Certification: Submit one copy of certification that subfloor complies with moisture content requirements specified under Part 3.1A.
8. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
9. Manufacturer's Maintenance Data: Describing the cleaning methods, cleaning solutions recommended, stain removal methods, and polishes and waxes.
10. Provide name of city and state where materials specified in this section were manufactured.

1.4 DELIVERY AND STORAGE

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use in accordance with Section 01-6500 and Section 01-6600. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
- C. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.5 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with reference standards and manufacturer's printed recommendations..
- B. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.
- C. Provide adequate illumination in the work area, equal to that available for final inspection.

1.6 EXTRA MATERIALS

- A. Tile and Trim Units: Furnish to Owner quality of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size. Package for storage with labels intact.

PART 2 - PRODUCTS

2.1 FLOOR TILE

- A. Ceramic Tile: Standard Grade, complete with accessories, complying with ANSI 137.1 and the following:
 1. Ceramic Tile Non-Vitreous Moisture Absorption: 7.0 percent or greater.
 2. Mosaic Porcelain Tile Moisture Absorption: 0.5 or less.
 3. Edges: Cushioned.
 4. Type/Size/Finish/Color/Manufacturer: As scheduled.

- B. Base Units: Units to match adjoining floor tile.
 - 1. Size: As scheduled, coordinated with sizes and coursing of floor tile.
 - 2. Type: Coved with bullnose edge at top of terminating base (with no wall tile).

2.2 WALL TILE

- A. Type: Standard Grade ceramic tile, complete with accessories, complying with ANSI/TCA 137.1 and the following:
 - 1. Moisture Absorption: 7% +.
 - 2. Corners: Square interior and exterior.
 - 3. Type/Size/Finish/Color/Manufacturer: As scheduled.

2.3 MORTAR

- A. For Thinset Method: Latex thinset bondcoat, dry-set cementitious mortar, ANSI/TCA A118.4.
- B. For Full Bed Method: Mortar consisting of ASTM C150 Portland Cement with latex additive, ASTM C144 sand and potable water complying with quality established by ANSI A108.1 and TCA F112

2.4 GROUT

- A. Manufacturer: Ultra-color manufactured by Mapie, www.mapei.us
 - 1. Type: Sanded Tile Grout, ANS I A118.3 quality.
 - 2. Color: To be selected by Architect from manufacturers standard options.

2.5 GROUT SEALER

- 1. Manufacturer: "Grout Sealer" manufactured by Custom Building Products, www.custombuildingproducts.com
- 2. Type: Penetrating, clear.

2.6 WATERPROOFING

- A. Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 - 1. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.

2.7 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.

2.8 WALL TILE ADHESIVE

- A. Organic Adhesive: ANSI A136.1, Type 1 thinset bond type.

2.9 ACCESSORIES

- A. Sealant: (1 part) urethane, ASTM C834 quality, complete with primer of compatible type recommended by sealant manufacturer.
- B. Marble Thresholds: Comply with ASTM C503 requirements for exterior use and for abrasion resistance where exposed to foot traffic, a minimum hardness of 10 per ASTM C241.
 - 1. Color as indicated on Finish Drawings.
- C. Cementitious Underlayment to achieve slopes: See Section 03-5400.

2.10 MANUFACTURERS

- A. The following manufacturers are acceptable:
 - 1. For Ceramic Floor Tiles:
 - a. American Olean, www.americanolean.com (Basis of Design)
 - b. Dal-Tile Corp www.daltile.com
 - c. Royal Mosa, <http://www.mosa.nl/us>
 - 2. For Grout:
 - a. Custom Building Products/Grand Prairie, Texas.
 - b. Dal-Tile Corp,
 - c. H.B. Fuller Co/Tewksburg, Massachusetts.
 - d. Laticrete International Inc/Bethany, Connecticut.
 - 3. For Sealant:
 - a. Dow-Corning Corp/Midland, Michigan.
 - b. Pecora Corp/Harleysville, Pennsylvania.
 - c. Sonneborn (Rexnord), Chicago, Illinois.
- B. Other manufacturers are acceptable for evaluation only after compliance with substitution requirements specified in Section 01-2513.

PART 3 - EXECUTION**3.1 FLOOR PREPARATION**

- A. Before installing floor tiles:
 - 1. Concrete floors shall be dry and exhibit negative alkalinity, carbonization, or dusting.
 - 2. All concrete surfaces scheduled to receive floor tiles shall be tested for moisture content using a calcium chloride moisture test complying with ASTM F1869.
 - 3. Certification verifying that subfloor has dried out consistent with application of floor tile is required.

3.2 INSTALLATION GENERAL

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts condition of existing surfaces

- C. Protect surrounding work from damage or disfiguration.
- D. Vacuum clean substrates.
- E. Verify that electrical and mechanical work beneath areas to be tiled is complete before proceeding with installation.
- F. Seal concrete substrate surface cracks with filler.
- G. Waterproofing: Install waterproofing on floor slab under ceramic tile and on wall under ceramic tile in Toilets, Baths, Showers, and similar wet areas and under DUROCK board on walls a minimum of 8" above floor as recommended by waterproofing membrane manufacturer and TCA.
- H. Crack Isolation Membrane: Install over cracks in existing concrete slabs and under thinset tile installations in general. Do not install where waterproofing is used.

3.3 FLOOR TILE INSTALLATION

- A. Interior Tile Floors and Marble Thresholds Concrete Substrate:
 - 1. Perform floor tile, marble threshold and waterproofing work in accordance with TCA "Handbook for Ceramic Tile Installation" and ANSI specifications referenced in TCA Handbook and manufacturer's instructions.
 - 2. Full Mortar Bed: 3/4" to 1-1/4" thick, TCA No. F112.
- B. At Door Openings: Do not interrupt tile pattern through openings from one room to another.
- C. At Exposed Edges of Ceramic Tile: Place marble thresholds unless indicated otherwise, to conform with ADA.
- D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly.
- E. Provide complete mortar coverage on the back of each tile, pressing each tile into place.
- F. Tile Joints:
 - 1. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size.
 - 2. Lay out tile work, center in both directions in each space. Adjust to minimize tile cutting unless directed by Architect.
 - 3. Install expansion joints according to TCA Method EJ171.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Grouting:
 - 1. Comply with ANSI A108.10.
 - 2. Allow wall tile to set for a minimum of 48 hours prior to grouting.
 - 3. Use type of grout approved by Architect.
 - 4. Make joints watertight without voids, cracks and excess grout.
- I. Marble Thresholds:
 - 1. Organic Adhesive: ANSI A136.1, Type I.

3.4 WALL TILE INSTALLATION

- A. Perform wall tile work in accordance with TCA "Handbook for Ceramic Tile Installation" and ANSI specifications referred to in TCA Handbook.
 - 1. Organic Adhesive Over Cementitious Backer Units: TCA W223.
- B. Do not use adhesives in a closed, unventilated area.
 - 1. Comply with adhesive manufacturer's printed instructions.

3.5 SEALANT WORK:

- A. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
- B. Comply with sealant manufacturer's printed instructions.

3.6 REPLACEMENT

- A. Replace cracked, chipped, broken and otherwise defective tiles and marble thresholds.

3.7 SEALER APPLICATION

- A. Allow grout to cure for three weeks minimum.
- B. Thoroughly clean grout joints.
- C. Apply two coats of grout sealer to joints according to manufacturer's instructions.
- D. Allow sufficient time for first coat to dry completely before applying second coat.
- E. Do not apply sealer to glazed tile or nonporous surfaces.

3.8 CLEANING AND PROTECTION

- A. Cleaning:
 - 1. Clean tile surfaces in accordance with tile manufacturer's recommendations and Section 01-7400.
- B. Apply to all clean, completed tile floors a protective coat of neutral cleaner solution mixed in accordance with tile manufacturer's instructions.
- C. Damp Curing: After cleaner solution has been applied, cover all tile floors with heavy-duty non-staining construction paper, masked in place.
- D. Just before final acceptance of tile work, remove paper and rinse the protective coating from all tile surfaces.
- E. Do not permit traffic over finished floor surface.
- F. Prohibit activities near wall finish for 7 days after installation.

END OF SECTION

SECTION 09-5133
ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid system, complete with acoustical ceiling panels for interior installations.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Indicating all technical information which specifies full compliance with requirements of this Section, including installation instructions for grid system and ceiling panels.
 - 2. Samples: For each type of grid system including wall molding, main runner, cross tees, and 6" x 6" sample of each type of ceiling panels.
 - 3. Qualification data for firms to demonstrate their capabilities and experience. Include list of completed projects, addresses, names of Architects and Owners.
 - 4. Certifications: Manufacturer's certifications that products comply with specified requirements including laboratory reports for tests and standards indicated.
 - 5. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals
 - 1. Extra Stock: As specified elsewhere within this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in acoustical ceiling systems, similar to that specified, with five years minimum experience.
- B. Installer: Suspended acoustical ceiling work shall be performed by a firm with a minimum of three years of successful experience in the type of work specified in this Section.
- C. Coordination of Work:
 - 1. Coordinate the layout and installation of suspended grid components and ceiling panels with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partitions systems (if any).
- D. Seismic Performance: Provide acoustical ceiling system that has been evaluated by an independent party and found to be compliant with the 2003 International Building Code, Seismic Category D, E, and F:
 - 1. Tested per International Code Council – Evaluation Services – AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components as evidenced by International Code Council Evaluation Report, ESR-1308.

1. Refer to Architectural and Structural drawings for specific details.

1.4 DELIVERY, HANDLING, STORAGE

- A. Do not deliver ceiling panels to job-site until the temperature conditions specified under "Environmental Requirements" of this Section are complied with.
- B. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels and in accordance with Section 01-6500.
- C. Store and protect ceiling grid components in accordance with manufacturer's recommendations and Section 01-6600.
 1. Store ceiling panels in the environmental conditions required under "Environmental Requirements" of this Section.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not begin installation until all wet work such as concrete, is completed and thoroughly dried out. Building areas to receive ceilings shall be free of construction dust and debris.
- B. Do not begin installation of ceiling panels until suitable mechanical ventilation is supported to maintain condition ranges of 60 degrees F to 85 degrees F at not more than 70% R.H.
 1. These conditions must be continuously maintained at least one week prior to installation of ceiling panels, during installation, and after installation of panels up to Date of Substantial Completion.

1.6 EXTRA MATERIALS

- A. Provide 2% of the installed amount of ceiling panels for each type and color and 24 pieces each of 4'-0" long tees and 2'-0" long tees, in accordance with Section 01-7700. Store in location as directed by the Owner.
- B. Provide extra ceiling tile and grid pieces in quantities indicated on Finish Drawings.

PART 2 - PRODUCTS

2.1 SUSPENSION SYSTEMS

- A. General: Each type of grid system specified below shall be complete with die-cut components of interlocking types and matching wall moldings, including accessories required to complete the grid installations, with maximum deflection of 1/360, conforming to requirements of ASTM C635 and ASTM C636. Tees shall be double web steel (ASTM A366) construction for direct hung installation.
 1. Structural Classification: Intermediate duty.
 2. Web Height of Main Runner: 1-1/2", and 1-1/2" on cross tee unless indicated otherwise. Each exposed bottom flange shall be continuous with unbroken roll formed steel cap, extending the length of the member.
 3. Wall Moldings: Hemmed angle molding with nominal 9/16" exposed flange, made from .019" nominal steel.

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4. Hanger Wire: 12 gage min. dia. galvanized carbon steel (ASTM A641), soft temper, prestretched, with a yield stress load of at least 3 times design load.
5. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
6. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.
7. Finish: All steel roll-formed parts, including cap, shall be chemically cleaned, electrogalvanized and protective-conversion coated. All exposed surfaces, except aluminum, shall then receive a baked polyester finish. Aluminum caps shall be etched and receive a lacquer finish.
8. Use: Coordinate grid use locations with tiles as specified on the Finish Drawings.

2.2 NON-RATED EXPOSED GRID SYSTEMS

- A. Product: Armstrong's PRELUDE, 15/16" Exposed Tee System.
 1. Grid Size: To fit panel size scheduled.
 2. Color: Factory-painted, white.
- B. Product: Armstrong's Hot Dipped Galvanized Clean Room Grid No. 7907 Series with aluminum capped exposed cross tee, size 1-1/2" x 1-1/2".
 1. Gasket: Norton closed-cell, type V764 (1/8" tall x 1/4" wide) or 3M #4718 closed cell gasket.

2.3 CEILING PANELS

- A. Lay-in Panels for 15/16" Exposed Grids:
 1. Designation: AC-1, AC-2
 2. Manufacturer: As indicated on Finish Drawings.
 3. Material: Wet-formed mineral fiber.
 4. Surface Design/Finish/Size: As indicated on Finish Drawings.
 5. Edges: Square Cut Lay-in.
 6. Color: White.
 7. NRC: .50 - .60 (ASTM C423).
 8. CAC: 35 - 39 (ASTM E413).
 9. Flame Spread Rating: Class A (ASTM E1264) and FS SS-S-118B, Flame Spread 25 (ASTM E84) or under, (UL Label).
- B. Lay-in Moisture-Resistant Panels
 1. Designation: AC-3
 2. Manufacturer: As indicated on Finish Drawings.
 3. Material: Ceramic and mineral fiber composite.
 4. Surface Design/Finish/Size: As indicated on Finish Drawings.
 5. Edges: Square-cut lay-in.
 6. Color: White.
 7. NRC(ASTM C423): .55-65 perforated.
 8. CAC (ASTM E413): 40-44.
 9. Flame Spread Rating: Class A (ASTM E1264) and FS SS-S-118B Flame Spread 25 (ASTM E84) or under (UL label).

2.4 MANUFACTURERS

- A. The following manufacturers are acceptable. Other manufacturers are acceptable for evaluation only after compliance with Sections 01-2513.
- B. For Ceiling Grid System:
 - 1. Armstrong World Industries.
 - 2. Chicago Metallic Corporation.
 - 3. USG Ceilings (Donn Brand).
- C. For Ceiling Panels:
 - 1. Armstrong World Industries.
 - 2. USG Interiors.
 - 3. Certaineed

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other Sections.
- B. Verify that existing conditions are ready to receive work.
- C. Verify that layout of hangers will not interfere with other work.
- D. Beginning of suspended acoustical ceiling work means acceptance of existing conditions.
- E. Verify that conditions are adequate to be able to meet seismic requirements.

3.2 INSTALLATION – CATEGORY D,E,F

- A. Install suspension system and panels in accordance with the International Building Code, Section 1621, manufacturer recommendations, and with the authorities having jurisdiction.
- B. ESR-1308, Section 4.4.3.1, Alternate Seismic Design Category D,E and F Installation:
 - 1. Under this installation, the runners must be rated heavy-duty and have a minimum simple span uniform load of 16.35 pounds per lineal foot (238 N/m); maximum ceiling weight permitted is 1.80 pounds per square foot (8.78 kg/m²).
 - 2. The BEREC-2 clip is used to secure the main runners and cross runners on two adjacent walls to the structure and the two opposite walls to the perimeter trim, as detailed below. A nominal 7/8-inch (22 mm) wall molding is used in lieu of the 2-inch (51 mm) perimeter supporting closure angle required by Section 9.6.2.6.2.2 (b) of ASCE-7 for Seismic Design Categories D, E and F. Except for the use of the BEREC-2 clip and the 7/8-inch (22 mm) wall molding and elimination of spreader bars, installation of the ceiling system must be as prescribed by the applicable code.
 - 3. The BEREC-2 clip is attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding. Clips installed on the walls where

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the runners are fixed are attached to the runner by a sheet metal screw through the horizontal slot in the clip into the web of the runner.

4. Alternate #2: If acceptable to architect, fixed attachment may be accomplished by pop-riveting the runner to the wall molding.
 5. Clips installed on the walls where the runners are not fixed to the runner allow the terminal runner end to move 3/4 inch (19.1 mm) in both directions. BERC-2 clips installed in this manner are an acceptable means of preventing runners from spreading in lieu of spacer bars required in CISCA 3-4, which is referenced in ASCE 7, Section 9.6.2.6.2.2, which is referenced in IBC Section 1621.
- C. The SJCG Seismic Separation Joint Clip is to be installed per the manufacturer's instructions, CS-3815.
- D. The presence of a hanger wire within 3 inches of an expansion relief joint as called for in ASTM C636 shall be required in addition to the requirements of the International Building Code, Section 1621.2.5 and with the authorities having jurisdiction.
1. Only applies when using Prelude XL Fire Guard 15/16"; Prelude Plus XL Fire Guard 15/16"; and Suprafine XL Fire Guard 9/16" Exposed Tee Systems.
- E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.
- F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.
- 3.3 ADJUSTMENTS AND CLEANING
- A. Adjust any sags or twists which developed in the ceiling systems.
- B. Clean exposed surfaces of grid systems and ceiling panels, including trim and edge moldings.
1. Comply with manufacturer's published instructions for cleaning and touch-up of minor damage to finish.
- C. Remove and replace work which cannot be successfully cleaned and repaired to a condition which permanently eliminates evidence of damage.

END OF SECTION

SECTION 09-6513.13
RESILIENT BASE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Resilient top set wall base, complete with accessories.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Describing physical and performance characteristics, sizes and colors available for wall base and installation instructions.
 - 2. Samples: 2" long illustrating the available colors for wall base.
- B. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100
- C. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals
 - 1. Extra Stock: As specified elsewhere within this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Provide resilient wall base and accessories as produced by a single manufacturer.
- B. Installer: Certified in writing by manufacturer as qualified for installation of resilient wall base.

1.4 DELIVERY, HANDLING AND STORAGE

- A. Products shall be delivered to job site in original unopened packages bearing manufacturer's labels.
 - 1. Comply with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.

1.5 EXTRA MATERIALS

- A. Provide 2% of the installed amount of resilient base, in accordance with Section 01-7700. Store in location as directed by the Owner.

PART 2 – PRODUCTS

2.1 RESILIENT WALL BASE

- B. Type: 4" & 6" rubber base – Johnsonite, Recess profile rubber base, color as indicated on Finish Drawings.
- C. 4" Millwork rubber base – Johnsonite, Millworks, Reveal profile, color as indicated on Finish Drawings.
 - 1. Substitutions: Products of other manufacturers are acceptable:
 - a. Roppe
 - b. Flexco

2.2 ACCESSORIES

- A. Subfloor Filler: Type recommended by flooring material manufacturer.
- B. Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Joint Sealer: Provide manufacturer's recommended plastic filler for sealing joints between top of wall base and irregular wall surfaces.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Before installing base, prepare surfaces in accordance with wall base manufacturer's published instructions.
- B. Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where wall base is required.
- C. Install base on solid backing. Bond tight to vertical substrate with continuous contact at horizontal and vertical surfaces.
- D. Fit joints tight and vertical. Do NOT use pieces less than 18 inches long.
- E. At Corners:
 - 1. Miter inside corners.
 - 2. Notch back of base to allow for smooth outside corner transition.
 - 3. Install corners per manufacturer's instructions for best installation.
- F. Scribe and fit to door frames and other interruptions.

END OF SECTION

SECTION 09-6516
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install resilient sheet flooring (wood vinyl and seamed vinyl) with wood grain and granite appearance, including adhesives and accessories.

1.2 QUALITY ASSURANCE

- A. Provide each type of resilient sheet flooring and accessories from a manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.
- B. Installer: Certified by resilient sheet vinyl manufacturer.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's technical data for each type of resilient flooring and accessory.
 - 2. Manufacturer's standard color chart in the form of actual selections of resilient sheet flooring, including accessories, showing full range of colors and patterns available.
 - 3. Two copies of manufacturer's recommended maintenance practices for resilient sheet flooring and accessories required.
 - 4. Jointing, Termination Details; Includes 8 ½" x 11" details indicating joint method, termination details including reducers and/or caps required.
 - 5. Moisture Test Results using a Calcium Chloride Moisture Test to be submitted to the Flooring Distributor prior to delivery and installation of resilient sheet flooring. A reading of three (3) pounds per 1000 square feet per 24 hours or less is an acceptable reading. If a concrete sealer was used, break bond past sealer for accurate reading.
 - 6. Concrete pH must be under 9. Perform test and submit results to Flooring Distributor.
 - 7. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals.
 - 1. Warranty: Written warranty and supporting letter as specified elsewhere within this section.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.

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- B. Store and protect materials in accordance with manufacturer's recommendations. Store rolls vertically.

1.5 PROJECT CONDITIONS

- A. Verify that Fortifiber "Moistop" Underslab Vapor Barrier or equal has been installed under work of Section 03300. Concrete contractor shall not create holes in membrane. Repair holes as they appear.
- B. Maintain minimum temperature of 70°F and maximum temperature of 85°F in spaces to receive resilient flooring for at least one week prior to installation, including all weekend hours, and for not less than 7 days after installation. Permanent heat must be used. Space heaters are not acceptable. Subsequently, maintain minimum temperature of 55°F and a maximum temperature of 85°F in areas where work is completed.
- C. Store resilient flooring materials in spaces where they will be installed for at least 72 hours before beginning installation.
- D. Install resilient flooring and accessories after other finishing operations, including painting, have been completed.
- E. Do not install resilient flooring over concrete slabs until they have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test. Concrete must be free of curing compounds or adhesives and have a compressive strength of 3500 psi or greater.
- F. Close areas to traffic and to other work until flooring is firmly set. Flooring shall have no foot traffic for 24 hours and no heavy fixtures or rolling carts are to be used on the floor for 72 hours. If traffic is necessary, cover floor with plywood.
- G. Where solvent based adhesives are used, provide safety, spark-proof fans when natural ventilations not adequate.
- H. Subflooring must be dry.
- I. Floor covering should not be installed over expansion joints. Expansion joint covers compatible with floor covering should be used.
- J. Do not install floor covering over existing VCT or VAT without using an approved underlayment to hide tile seams.
- K. Inspect substrate for any contamination, such as oil drippings, cutback adhesives, etc. Encapsulate contamination with an encapsulate before progressing with the installation of the floor covering. The use of solvent-based adhesive removers is NOT recommended. Mapei's Plan/Patch Plus and Ardex 15 are acceptable coverings. Self-leveling underlayments can have very high moisture contents and require longer curing times, some up to 10 days. Check with a moisture meter before starting installation.

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1.6 EXTRA MATERIALS

- A. Provide 2 percent of each color and pattern of flooring in accordance with Section 01-7700. Store in location as directed by the Owner.

1.7 WARRANTY

- A. Ten (10) year limited warranty commencing on date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Provide products manufactured by Mannington, www.mannington.com/commercial

- 1. Substitutions: Products by the following manufacturers are acceptable:
 - a. Armstrong, www.armstrong.com
 - b. Azrock, www.azrock.com

2.2 RESILIENT SHEET FLOORING

- A. Description and Physical Characteristics:

- 1. Width: 6' feet.
- 2. Nominal Thickness: 2.34 non-cushioned.
- 3. Test Data:
 - a. Flammability: Meets or exceeds ASTM D648, Class I (0.45 watts/cm).
 - b. Smoke Density ASTM-662-94 <450 per ASTM 648-94A Class 1.
 - c. Residual Indentation: ASTM F-970 Fed St. 501A-3231 Type 1 (1100 p.s.i.)
 - d. Resistance to Solvents: Complies with ASTM F1303.
 - e. Slip Resistance: Static Coefficient D-2047-93, in compliance with AD requirements.
 - f. Wear Resistance: 12,000 cycles, 500 g. load, S-33 (Taber Abrasion Test, when patterns worn out).
 - g. Wear Layer: Type 1, Grade 1 per ASTM F1303, embossed clear PVC wear layer of .20".
 - h. Test Performance: Critical Radiant Flux (ASTM E648-94A) Class 1
- 4. Styles:
 - a. Wood Vinyl Flooring: As indicating on Finishes Drawings.
 - b. Seamed Vinyl Flooring: As indicated on Finishes Drawings.

2.3 ACCESSORIES

- A. Adhesives: As recommended by flooring manufacturer to suit material and substrate conditions.
- B. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- C. Patching, Leveling, Underlayment: Mastic Latex type equivalent to Camps latex underlayment.

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- D. Welding Rods: Manufacturer's standard or equal; color as selected by Architect.
- E. Chemical Weld: Manufacturer's standard or equal.
- F. Terminating Reducers: Manufacturer's standard; color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine subfloor surfaces to determine that they are dry, clean, and smooth.
- B. Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compound. Do not use curing compound on concrete subfloors.
- C. Perform moisture tests in accordance with related paragraphs found under Submittals within this specification section.
- D. Submit moisture and concrete pH tests to Flooring Distributor before ordering flooring product.
- E. Perform bond test at the rate of one per 50 square feet.
- F. Do not allow resilient sheet flooring work to proceed until subfloor surfaces are satisfactory. Indicate adverse conditions of any type by letter to Architect and Flooring Distributor.

3.2 PREPARATION

- A. Sand or grind subfloors to remove mortar, paint, and other surface irregularities.
- B. Where leveling is required, apply latex type underlayment in two or more applications. Apply compound in accordance with manufacturer's printed instructions.
- C. Remove all debris, sand, and other materials which result in lack of adhesion or telegraphing

3.3 GENERAL INSTALLATION PROCEDURES

- A. Install resilient sheet flooring and accessories using method indicated in strict compliance with manufacturer's printed instructions.
- B. Extend resilient sheet flooring into toe spaces, door reveals, and into closets and similar openings.
- C. Scribe, cut and fit resilient sheet flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets and permanent columns, walls and partitions. Floor shall be tight to door bucks.

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- D. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-staining marking device.
- E. Tightly cement resilient sheet to sub base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll resilient sheet flooring at perimeter.
- F. Use a 2-part epoxy adhesive, recommended by the Flooring Distributor, under any hospital beds or border pieces.

3.4 RESILIENT SHEET FLOORING INSTALLATION PROCEDURES

- A. Roll out resilient sheet flooring material with top surface up. Trim off all damage edges. Allow material to relax for twenty four (24) hours.
- B. Trim off all damaged ends
- C. Straight edge and underscribe all side and end seams.
- D. Fold back sheet half-way. Spread adhesive with replaceable blade type notched trowel. Fold sheet into adhesive, allowing for a pattern match.
- E. Roll sheet with 150 pound roller. Hand roll all seams.
- F. Seams
 - 1. Heat weld all seams
 - a. Route material to accept heat weld roll
 - b. Melt matching welding thread into grooves using heat weld gun.
 - c. Use guide plate on spatula knife when trimming the weld rod the first time. Wait a minimum of one hour before doing final trim using a Winkelman WDD645 Slim Trim Knife. (Toll-Free: 1-800-929-4326)
 - 2. Chemical weld all seams using Mannington's MLG33 low gloss commercial seam welding.

3.5 FINISHING AND CLEANING

- A. Perform the following initial cleaning operations immediately upon completion of resilient flooring following manufacturer's maintenance instructions.
 - 1. Sweep or vacuum floor thoroughly to remove any loose dirt, dust and other foreign materials.
 - 2. Scrub floor surface using a buffing machine with a 450 or less RPM maximum speed along with a solution of lukewarm water and mild stripper (pH 9 maximum). After scrubbing is complete, wet-vac surface with heavy duty commercial wet vacuum. Rinse floor thoroughly with clean lukewarm water and again wet-vac surface to remove all excess water.
 - 3. Do not scrub floor with steel wool pads, wire brushes, aggressive floor cleaners or cleansers. These products can cause severe scratching and damage to the floor surface.

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3.6 PROTECTION

- A. Protect resilient sheet flooring against damage during construction period to comply with resilient sheet flooring manufacture's directions. Keep furniture off the floor for 24 hrs. Do not allow rolling carts to be used on the floor for at least 72 hrs.

END OF SECTION

SECTION 09-6519
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Vinyl composition tile flooring, complete with accessories.
- B. Vinyl enhanced tile flooring, complete with accessories.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Indicating all technical information which specifies full compliance with requirements of this Section, including installation instructions.
 - 2. Certification: Subfloor complies with moisture content requirements specified under Part 3.1, A.
 - 3. Samples: 2" x 2" in size, illustrating the available colors and patterns for floor tiles, 4" long edge strips illustrating the available colors.
 - 4. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals
 - 1. Maintenance Data: Indicating maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
 - 2. Extra Stock: As specified elsewhere within this section

1.3 QUALITY ASSURANCE

- A. Manufacturer: Provide resilient tile flooring and accessories as produced by a single manufacturer, including primers, adhesives, sealants, and leveling compounds.
- B. Installer: Installer shall be certified by resilient tile flooring manufacturer.

1.4 DELIVERY, HANDLING, STORAGE

- A. Tile flooring materials shall be delivered in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect materials in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Maintain temperature and humidity within ranges required by manufacturer's instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for 48 hours min. prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer 24 hours prior to, during, and 24 hours after installation of materials.

1.6 EXTRA MATERIALS

- A. Provide 2 percent of each color and pattern of resilient floor tile in accordance with Section 01-7700. Store in location as directed by the Owner.
- B. Provide extra resilient base in quantities indicated on Finish Drawings.

PART 2 - PRODUCTS

2.1 RESILIENT TILE

- A. Type (VCT): Commercial grade, resilient tile composed of vinyl resins, plasticizers, stabilizers, fillers and pigments, commercial quality, asbestos free, conforming to requirements of FS-SS-T-312B, Type IV, composition.
 - 1. Manufacturer/Design/Pattern/Color: As indicated on Finish Drawings.
 - 2. Wear Thickness: Design/pattern and color extending uniformly throughout.
 - 3. Smoke Development (ASTM E662): 450 or less
 - 4. Critical Radiant Flux (ASTM E648): 0.45 watts/cm² or more, Class 1.
 - 5. Size: As indicated on Finish Drawings
- B. Feature Tile/Feature Strips:
 - 1. Manufacturer/Design/Pattern/Color: As indicated on Finish Drawings.
 - 2. Match characteristics and properties commercial grade tile specified above.
 - 3. Size: As indicated on Finish Drawings.

2.2 ACCESSORIES

- A. Subfloor Filler: Type recommended by flooring material manufacturer.
- B. Adhesives:
 - 1. General: Waterproof; types recommended by flooring manufacturer.
 - 2. For Rooms with Hospital Beds: Use an epoxy adhesive recommended by resilient tile manufacturer for that use, under the entire bed area if 1/8 inch thick resilient tile is scheduled as floor finish.
- C. Carpet Adaptor: As indicated on Finish Drawings

2.3 MANUFACTURER

- A. The following manufacturers are acceptable:
 - 1. Mannington, www.mannington.com/commercial (Basis of Design)
 - 2. Armstrong, www.armstrong.com
 - 3. Teknofloor www.teknoflor.com
- B. Other manufacturers are acceptable for evaluation only after compliance with substitution requirements specified in Section 01-2513.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installing floor tiles:

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1. Concrete surfaces shall be smooth and flat with maximum variation of 1/8" in 10 ft. and ready to receive tiles.
 2. Do not install flooring on concrete which has been sealed.
 3. Concrete floors shall be dry and exhibit negative alkalinity, carbonization, or dusting.
 4. All concrete surfaces scheduled to receive floor tiles shall be tested for moisture content using a calcium chloride moisture test or other test method approved by manufacturer of floors.
 5. Certification verifying that subfloor has dried out consistent with application of vinyl flooring is required.
- B. Remove ridges and bumps from concrete surfaces. Fill low spots, cracks, joints, holes and other defects with subfloor filler.
- C. Remove coatings from surfaces that would prevent bond, including curing compounds incompatible with adhesives, paint, oils, waxes and sealers.
- D. Vacuum or broom clean the substrate immediately before the application of flooring.
- E. Prepare and prime surfaces in accordance with adhesive manufacturer's published instructions.
- F. Beginning of installation means acceptance of substrate and site conditions.

3.2 INSTALLATION

- A. Install floor tile in accordance with latest edition of manufacturer's published instructions.
- B. Mix the tile from container to ensure shade variations are consistent.
- C. Spread only enough adhesive to permit installation of resilient tile before initial set.
- D. Set floor tiles in place, press with heavy roller to attain full adhesion.
- E. Tile Pattern:
1. Lay tiles with all joints aligned to square grid pattern and pattern grain parallel with all units, and parallel to length of room.
 2. Lay tiles with all joints aligned to square grid pattern and pattern grain alternating with adjacent units to produce basket weave pattern.
 3. Allow minimum 1/2 full size tile width at room or area perimeter.
- F. Terminate floor tiles at centerline of doors where adjacent floor finish is dissimilar.
- G. Edge Strips: Install at unprotected or exposed edges, and where flooring terminates.
- H. Scribe floor tiles to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- I. Floor tiles shall be installed over covers for telephone conduits, electrical conduits, and other similar items which occurs within the finished floor areas.

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1. Tiles must be cut sharp and clean around these covers so that the covers can be removed when required.
2. The tile must be applied to covers in a solid application of adhesive.

3.3 PROTECTION AND CLEANING

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Remove excess adhesive from floor tiles and wall surfaces without damage.
- C. Clean, apply polish, and buff with type of polish, number of coats and buffing procedures in accordance with manufacturer's instructions.
- D. Perform initial maintenance according to latest edition of manufacturer's maintenance manual.

END OF SECTION

EPOXY POLYMER FLOORING SYSTEM 09-6727
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SECTION 09-6727
EPOXY POLYMER FLOORING SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Epoxy polymer floor system.

1.2 QUALITY ASSURANCE

- A. Installer: Firm shall have satisfactorily completed a program of instruction in proper methods of preparation of the substrate, and delaminated areas, crack and joint repair and flooring installation. The applicator shall have in writing a certificate of approval from the manufacturer and have proven experience with the specified system. Applicator shall have a minimum of five (5) years experience with comparable installations.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver material to job site in clean, clearly labeled containers and inspect prior start of job.
- B. Store material in a dry, enclosed area protected from the elements. Keep temperature of storage area between 60° and 90° F.
- C. Comply with Sections 01-6500 and 01-6600.

1.4 PROJECT/SITE CONDITIONS

- A. Minimum concrete surface temperature of 55 degrees F (12 deg. C) for 48 hours before, during, and after installation, or until cured.
- B. Adequate ventilation and clean water supply required during installation.
- C. Concrete:
 - 1. Moisture Content - Non-Destructive: Securely tape squares of heavy-duty polyethylene film sheeting (10 mil gauge minimum) to the substrate. Place an infrared heat lamp twenty-four (24) inches above the polyethylene film for twenty-four (24) hours in the on position and observe for accumulation of moisture under the film.
- D. Control Joints:
 - 1. The Contractor may fill non-moving control joint(s) with approved elastomeric sealant for full depth semi-rigid two component epoxy joint filler, designed specifically for this purpose (use full depth joint filler when reinforcement of the joint edges is desired). Movement may crack surfacing unless proper detailing has been done.
 - 2. Filling moving isolation joints or expansion joints is not recommended.
 - 3. Filling of non-moving isolation joints or expansion joints with a semi-rigid epoxy

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joint filler, Masterfill CJ by Master Builders, is acceptable.

1.5 WARRANTY:

- A. Submit a one-year warranty against defects in material and workmanship upon substantial completion of installation.

1.6 SUBMITTALS:

- A. Make submittals following Section 01-3323.
 - 1. Product data: Submit six (6) copies of manufacturer's specifications on specific components of the cured system, including physical and performance properties.
 - 2. Samples: Submit two (2) finished samples as a representation of the finished system to verify thickness color and finish texture approval.
 - 3. Documentation: The installer shall furnish a list of Project using either the specified material, or equivalent material installed within the last five years.
 - 4. Maintenance Instructions: Submit manufactures written instructions for recommended maintenance.
 - 5. Submit a one-year warranty against defects in material and workmanship upon substantial completion of installation.
 - 6. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

PART 2 - PRODUCTS

- 2.1 Acceptable manufacturer: Dur-A-Flex Inc., General Polymers Corp, Tnemec Co, Inc. or approved equal.

2.2 Product Description:

- A. ¼ inch Dur-A-Quartz TM with polythane #2 flat multiple component, seamless, decorative, trowel applied, epoxy floor system as manufacture by Dur-A-Flex, Inc.
- B. Epoxy Resin Flooring System:
 - 1. Dur-A-Glaze #4, 100% solids epoxy resin
 - 2. Q28 – natural rounded, translucent Quartz aggregate
 - 4. Elast-O-Coat waterproofing membrane
 - 5. Poly-Than 2 UV CRU topcoat

- 2.3 Product Mixing: Mix on site and in accordance with manufacturer's instructions. Use only manufacturer supplied mix and measure apparatus to ensure a timely, accurate mix ratio and minimize waste.

PART 3 – EXECUTION

3.1 Substrate Preparation:

- A. Concrete and ceramic tile surfaces: Shot-blast or power scarify as required to obtain surface profile for optimum bond of flooring to substrate and that meets the material manufacturers requirements.
- B. Floor Drains: Floor drains should be installed flush with the substrate. All drains

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shall be taped off and covered prior to epoxy installation

- 3.2 Product Installation: Install shall be in accordance with the manufacturer's written instructions.
- 3.3 Flooring Application:
- A. Trowel Application: Dur-A-Glaze #4, 100% solids clear epoxy with Bio Pruf Antimicrobial and Q28 quartz aggregate shall be troweled onto the surface. Following the troweled application, the area shall be broadcast with Q28 quartz aggregate to rejection and allowed to cure overnight. After this procedure, any excess aggregate shall be removed, and the surface shall be lightly sanded.
 - B. Topcoat: Dur-A-Glaze 100% solids epoxy shall be squeegeed onto the floor and back rolled. Smaller rollers and/or brushes shall be used to trim in around all columns, walls, and other obstacles. This application shall cure per the manufacturer's written specifications
 - C. Final Coat:
 - 1. Poly Thane 2, two-component chemical resistance urethane shall be squeegeed onto the surface and back rolled to ensure appearance and texture throughout the area. Smaller rollers and/or brushes shall be used to trim in around all columns, walls, and other obstacles.
 - 2. Surface texture "Standard" (maximum skid resistance). This application shall be cured per manufacturer's recommendations.
- 3.3 Clean Up: Upon completion of the project, the job site will be cleaned of all unused materials and debris.

END OF SECTION

**SECTION 09-6800
CARPETING**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Glue-down type carpet, complete with accessories.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Firm with minimum five years experience in successfully producing carpet similar to that indicated for this project.
- B. Installer: The work of this Section shall be performed by skilled workmen having a minimum of three years experience installing similar materials.
- C. Carpet Surface Burning Characteristics: Provide carpet identical to that tested by DOC FF-1-70 and by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify carpet with appropriate markings of applicable testing and inspecting organization.
- D. Provide materials manufactured and extracted from locations within 500 miles of project site.
- E. Use carpet adhesives with a VOC content of less than 50 g/L.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Indicating all technical information which specifies full compliance with requirements of this Section, including installation instructions for carpet and accessories.
 - 2. Shop Drawings: Showing carpet layout indicating carpet direction, and types of edge strips. Indicate locations where cutouts are required in carpet. Show details at special conditions.
 - 3. Samples/Carpet: 12" x 12" minimum size illustrating colors and patterns for each type of carpet specified.
 - 4. Samples/Edge Strips: 6" long pieces of each type specified.
 - 5. Laboratory Test Reports: Required from and certified by carpet manufacturer indicating the carpet specified is manufactured to meet or exceed the required fire rating for code compliance.
 - 6. Certification: Indicating that subfloor complies with moisture content requirements under Part 3.2, A.
 - 7. Manufacturer's Certification indicating compliance with ADA Accessibility Guidelines 4.5.3 for carpet pile thickness.
 - 8. Provide name of city and state where materials specified in this section were manufactured.
 - 9. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- B. Follow sections 01-7700, 01-7823 and 01-7833 for making closeout submittals.
 - 1. Maintenance Data: From carpet manufacturer, describing maintenance procedures, recommended maintenance materials and suggested cleaning schedule.

1.4 DELIVERY HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
- C. Maintain temperature and humidity within ranges required by manufacturer's instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

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

1.6 EXTRA MATERIALS

- A. Provide 5% of each pattern and color of carpet approved for the work in accordance with Section 01-7700. Store in location as directed by Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer - Carpet: Provide products manufactured by Mannington Commercial www.mannington.com/commercial
 - 1. Substitutions: Products by the following manufacturers are acceptable:
 - a. Shaw Contract, www.shawcontractgroup.com
 - b. Mohawk Industries, www.mohawkind.com

GLUE-DOWN CARPET

- A. Manufacturer, Gauge, Weight, Color: As Scheduled
- B. Carpet Backing: As indicated on Finish Drawings.

2.2 ACCESSORIES

- A. Sub-Floor Filler: Type recommended by carpet manufacturer.
- B. Primers and Adhesives: Waterproof; of types recommended by carpet manufacturer.
- C. Carpet Moldings: Vinyl types for glue-down carpet installations, complete with attachments of quality manufactured by Mercer Products Company Inc., Orlando, FL or products by substitute manufacturers Burke Flooring and Johnsonite.
 - 1. Carpet Reducer: Mercer 700, transition reducer for glue-down carpet, with 1-11/32" transition, 5/16" undercut.

2. Carpet to Resilient Transition: Mercer 710 transition reducer for glue-down carpet to resilient flooring.
3. Color: Color as scheduled

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Concrete floors shall be dry and exhibit negative alkalinity, carbonization, or dusting.
- B. All concrete surfaces scheduled to receive carpeting shall be tested for moisture content using a calcium chloride moisture test or other test method approved by manufacturer of floors.
- C. Certification verifying that subfloor has dried out consistent with application of carpeting is required.

3.2 PREPARATION

- A. General:
 1. Fill holes, cracks, low spots, and rough areas with sub-floor filler. Finish smooth.
 2. Prohibit traffic from areas until filler is adequately cured.
 3. Do not install flooring on concrete which has been sealed.
 4. Concrete shall be dry and exhibit negative alkalinity, carbonization, or dusting.
 5. All concrete surfaces scheduled to receive flooring shall be tested for moisture content using a calcium chloride moisture test or other test method approved by manufacturer of flooring.
 6. Certification verifying that subfloor has dried out consistent with application of flooring is required.
 7. Vacuum floor surfaces prior to carpet installation.
 8. Beginning of work means carpet installer accepts condition of concrete substrate.

3.3 INSTALLATION

- A. General:
 1. Verify carpet match before cutting to ensure minimal variation between dye lots.
 2. Comply with manufacturer's recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. Follow seaming diagram as submitted and approved.
 3. Center seams under doors; do not place seams in traffic direction at doorway.
 4. Locate change of color or pattern between rooms under door centerline.
 5. Extend carpet under open-bottomed obstructions and removable furnishings. Extend carpet into alcoves and closets of each space unless indicated otherwise.
 6. Provide cut-outs where required. Bind edges where not concealed by protective edge guards or overlapping flanges.
 7. Install edge guard where edge of carpet is exposed; anchor guards to substrate.
 8. Expansion Joints: Do not bridge building expansion joints with continuous carpeting; provide for movement.

9. Apply seam sealer at all seams and cut edges as recommended by the manufacturer.

B. Cutting:

1. Double-cut carpet to allow intended seams and pattern to match.
2. Make cuts straight, true and unfrayed.
3. Neatly cut and fit carpet tight to intersection with vertical surfaces without gaps.

3.4 CLEANING AND PROTECTION

- A. Remove adhesive from carpet and wall surfaces without damage
- B. Clean and vacuum carpet surfaces.
- C. Prohibit traffic from carpet areas for 24 hours after installation.

END OF SECTION

SECTION 09-8100
ACOUSTIC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Glass fiber sound-attenuation blankets.
- B. Sound-attenuation fire blankets for fire walls requiring sound control insulations.

1.2 QUALITY ASSURANCE

- A. Manufacturer: A firm with not less than five years of successful experience in producing sound attenuation blankets similar to that specified.
- B. Installer for Fire Blankets: A firm with at least three years of experience with installation of sound attenuation fire blankets.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
- B. Manufacturer's Product Data: Indicating full compliance with requirements of this Section.
- C. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Insulation shall be delivered in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect materials in accordance with manufacturer's recommendations and Section 01-6600.
 - 1. Store in a clean and dry place; protect against moisture.

PART 2 - PRODUCTS

2.1 SOUND-ATTENUATION BLANKETS

- A. Type: Owens-Corning's "Sound Attenuation" Batt Insulation, unfaced, complying with property requirements of ASTM C518; ASTM E84, N.F.P.A. 220.
 - 1. Thickness: 3-1/2"
 - 2. STC (ASTM E90): Rating: 44 minimum

2.2 SOUND-ATTENUATION FIRE BLANKETS

- A. Type: THERMAFIBER SOUND ATTENUATION FIRE BLANKETS, unfaced, complying with property requirements of ASTM C665/Type I and the following:

1. Burning Characteristics: Flame spread 15, smoke development 0, ASTM E84.
- B. Thickness: 3-1/2"
- C. STC (ASTM E90): Rating: 44 minimum

2.3 SUBSTITUTIONS

- A. Products of the following manufacturers are acceptable:
 1. CertainTeed Corp., Insulation Group.
 2. USG Interiors, Inc., USG Corp.
- B. Products of other manufacturers may be submitted for review in accordance with Section 01-2513.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 1. Install in accordance with manufacturer's published recommendations and without visible gaps or segregation.
 2. Refer to drawings for locations of installation. Coordinate locations of fire blankets in wall designated to be rated.
- B. In Walls:
 1. Do not install sound-attenuation blankets before mechanical and electrical work is complete.
 2. "Friction-fit" blankets between studs until wall cavities are completely filled, and without gaps and voids.
 3. Fit blankets tightly to mechanical and electrical items within the area of blankets.
 4. Pack insulation around door frames and view window frames, in cracks, and other voids.
 5. Where insulation must extend higher than 8 feet, secure insulation in place with wire strands with first wire placed horizontally at 8 feet above floor, then spaced horizontally 2 feet apart. Stretch tie wire strands at every fourth stud. Longer runs which are not tied at every fourth stud are not acceptable.

3.2 PROTECTION

- A. Protect the installed sound-attenuation blankets from physical abuse and the weather.
- B. Blankets which are damaged or becomes wet after installation shall be replaced with new blankets.

END OF SECTION

SECTION 09-8533
SOUND ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Acoustical wall treatment as shown on drawings.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Provide acoustical panels and accessories from a single manufacturer with a minimum of three years successful experience in producing acoustical panels similar to that specified for this project.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Manufacturer's Product Data: Describing physical and performance characteristics, sizes, patterns and colors available for acoustical panels and installation requirements.
- C. Samples: 6x6" in size, illustrating the available colors and patterns for acoustical panels.
- D. Maintenance Data: Indicating methods for cleaning and cleaning materials.
- E. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, STORAGE, HANDLING

- A. Deliver products to site in factory sealed and labeled containers in accordance with Section 01-6500.
- B. Store and protect products in accordance with Section 01-6600.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS

- A. Type: Silentspace Wall Panels molded under heat and pressure, faced with woven fabric, as manufactured by ESSI Acoustical Products Co., Cleveland, Ohio.
 - 1. Mounting: Mechanical clip
 - 2. Fabric: As noted on Finish Drawings
 - 3. Flame Spread: 25 or less, Smoke Developed Rating of 105, ASTM-E84 Burn Test.
 - 4. Sound Absorption: NRC of 80, ASTM C423.

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- B. The following manufacturers are acceptable. Other manufacturers are acceptable only after compliance with requirements with substitution requirements specified in Section 01-2513
 - 1. Acoustical Surfaces, Inc., Chaska, MN.
 - 2. Perdue Acoustics, Amarillo, Texas.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that all wet work is completed and dry.
- B. Space must be enclosed and weathertight with provisions for maintaining constant temperature and humidity.
- C. Report unacceptable conditions to the Architect. Do not begin installation until unacceptable conditions have been corrected.
- D. Beginning work means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions.
- B. Install panels only after completion of painting and other work in the area which might result in damage panels.

3.3 CLEANING

- A. Clean panels in accordance with manufacturer's instructions.

END OF SECTION

**SECTION 09-9100
PAINTING**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All field painting of interior and exterior exposed items and surfaces required to complete the work of this project including the following:
 - 1. Painting of exposed ducts, bare pipes and covered pipes, including hangers and color coding.
 - 2. Painting of exposed steel and iron work.
 - 3. Painting of primed metal surfaces of equipment under mechanical and electrical work except as otherwise indicated.
 - 4. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment under other Sections of work.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in paint manufacture with ten years experience.
- B. Employ only qualified painters with a minimum of three years experience for painting the materials specified in this Section.
- C. Use flat paints with a VOC content of less than 50 g/L.
- D. Use non-flat paints with a VOC content of less than 150 g/L.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Submit in accordance with Section 01-3323, clearly indicating technical information including paint label analysis and application instructions for each material proposed for use.
 - 2. Color Samples:
 - 3. Submit in accordance with Section 01-3323, clearly identifying full compliance with various colors listed in "Finish Schedule".
 - 4. Include color coding of mechanical and electrical equipment.
 - 5. Certification:
 - a. Certification letter from paint manufacturer that products comply with VOC standards.
 - 6. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, STORAGE, HANDLING

- A. Deliver products to site in factory sealed and labeled containers in accordance with Section 01-6500.

1. Container labeling shall include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
- B. Store and protect products in accordance with Section 01-6600.
 1. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in well ventilated area, unless required otherwise by manufacturer's instructions.
- C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. For purpose of designating type and quality of paint required, "Painting Schedule" specified in this Section is based on paints manufactured by Sherwin Williams.
 1. "Paint Schedule" specifies the minimum number of primer and finish coats acceptable, which establishes the paint "system" required for the work.
- B. For purpose of establishing color requirements, color numbers of a different manufacturer may be identified in "Finish Schedule".
 1. If so, paints approved in "Paint Schedule" shall be mixed to match color numbers identified in "Finish Schedule".

2.2 SUBSTITUTIONS

- A. The following manufacturers are acceptable:
 1. ICI Paint Stores.
 2. PPG Porter Paints
 3. Rodda Paint Co.
- B. Other manufacturers are acceptable for evaluation only after compliance with substitution requirements specified in Section 01-2513.

2.3 EXTERIOR PAINT SYSTEMS

- A. Non-Ferrous METAL - (Aluminum, Galvanized):
 1. 1st Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series
 2. 2nd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series (4 mils wet, 1.5 mils dry per coat)
- B. Ferrous Metal - (Misc. Iron, Ornamental Iron, Structural Iron & Steel,)
 1. 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
 2. 2nd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series
 3. 3rd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series (4 mils wet, 1.5 mils dry per coat)
- C. Concrete - (Cementitious Siding, Flexboard, Transite Board, Shingles (Non-Roof), Common Brick, Stucco, Tilt-up, Precast, and Poured-in-place Cement)
 1. Sherwin Williams System

- a. Semi-Gloss Finish
 - b. 1st Coat: S-W Loxon Concrete & Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
 - c. 2nd Coat: S-W Metalatex Semi-Gloss Coating, B42 Series
 - d. 3rd Coat: S-W Metalatex Semi-Gloss Coating, B42 Series (3-5 mils dry per coat)
- D. Wood (Cedar brackets and trim)
1. Stain:
 - a. Alkyd Type-Semi-transparent: Two coats of products manufactured by one of the following:
 - 1) Cabot, www.cabotstain.com
 - 2) Benjamin Moore www.benjaminmoore.com
 - 3) Coronado Paint, www.coronadopaint.com
 - 4) Approved substitute

2.4 INTERIOR PAINT SYSTEMS

- A. Concrete: Walls and Ceilings
1. First Coat: S-W PrepRite® Masonry Primer, B28W300(7 mils wet, 3 mils dry)
 2. Second Coat: S-W ProGreen™ 200 Interior Latex Eg-shel, B20W651
 3. Third Coat: S-W ProGreen™ 200 Interior Latex Eg-shel, B20W65 (4 mils wet, 1.6 mils dry per coat)
- B. Gypsum Wallboard Painted (Eg-shell/Satin):
1. First Coat: Primer, USG SHEETROCK First Coat.
 2. Second Coat Paint: S-W ProGreen™ 200 Interior Latex Primer, B28W600 Series (4 mils wet, 1.5 mils dry)
 3. Third Coat Paint: S-W ProGreen™ 200 Interior Latex Eg-shel, B20W651
- C. Gypsum Wallboard Painted-Flat Latex:
1. First Gypsum Board Primer: USG SHEETROCK First Coat.
 2. Second Coat Paint: S-W ProGreen™ 200 Interior Latex Primer, B28W600 Series (4 mils wet, 1.5 mils dry)
 3. Third Coat Paint: S-W ProGreen™ 200 Interior Latex Flat, B30W651
- D. Ferrous Metal Handrails, Doors and Frames Painted:
1. First Coat: S-W Kem Bond HS Primer, High Solids Universal Metal Primer (3 mils dry)
 2. Second Coat: S-W Industrial Enamel, Alkyd Enamel, B54Z Series (3 mils dry)
 3. Third Coat: S-W Industrial Enamel, Alkyd Enamel, B54Z Series (3 mils dry)
- E. Nonferrous Metal (Aluminum, Galvanized)
1. First Coat: S-W Pro Industrial Pro-Cryl Primer, B66-310 Series (2-4 mils dry)
 2. Second Coat: S-W ProGreen™ 200 Interior Latex Semi-Gloss, B31-600 Series
 3. Third Coat: S-W ProGreen™ 200 Interior Latex Semi-Gloss, B31-600 Series (4 mils wet, 1.6 mils dry per coat)
- F. Insulated Pipe:
1. First Coat: ProMar 200 Latex Semi-gloss B31W200 Series
 2. Second Coat: ProMar 200 Latex Semi-gloss B31W200 Series

G. CONCRETE – FLOORS

1. Single Component Floor Coating – ArmorSeal Treadlex B890 Series
2. Water Based Epoxy for Gypsum Board Walls and Ceilings
 - a. First Coat: S-W ProGreen™ 200 Interior Latex Primer, B28W600 Series (4 mils wet, 1.5 mils dry)
 - b. Second Coat: Hi-Bild WB Catalyzed Epoxy 5 mils dry)
 - c. Third Coat: Hi-Bild WB Catalyzed Epoxy 5 mils dry)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surfaces scheduled to be finished shall be examined prior to commencement of work.
 1. Painting Subcontractor shall report to General Contractor any condition that may potentially affect proper application.
- B. Prepare ALL surfaces in strict accordance with paint manufacturer's published instructions for each particular substrate condition.
 1. Clean surfaces to be painted before applying paint or surface treatments.
 2. Remove oil and grease prior to mechanical cleaning.
 3. Schedule the cleaning and painting so that contaminants from cleaning process will not fall on wet, newly painted surfaces.
- C. For Interior Painting:
 1. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures before, during and 48 hours after application of paint, in accordance with manufacturer's printed instructions.
- D. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in place which are not to be painted OR provide surface-applied protection prior to surface preparation and painting operations.
 1. Following the completion of painting work of each space or area, reinstall the removed items.
- E. Correct minor defects and clean surfaces which affect work of this Section.
- F. Shellac and seal marks which may bleed through surface finishes.

3.2 CLEAN-UP AND PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
- C. Repair damage to other surfaces caused by work of this Section.
- D. During progress of painting work:
 1. Remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

2. Maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.
3. Remove paint where spilled, splashed, or splattered.

3.3 APPLICATION

- A. All painting work shall be completed before carpet work is started.
 1. All walls shall be painted prior to installing ceiling grid/wall molding.
- B. Apply all coatings in accordance with manufacturer's published instructions.
 1. Do not paint over dirt, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of paint film.
 2. Provide barrier coats over incompatible primers or remove and reprime as required.
 3. Notify Architect in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
 4. Do not paint over code-required labels.
- C. Application Temperatures (unless required otherwise by manufacturer's instructions):
 1. 50 degrees minimum, 90 degrees maximum, humidity below 85 percent.
- D. Unless otherwise noted, all surfaces which will remain exposed to view (except factory finished items) shall receive field painting.
 1. Unless otherwise noted, factory primed items which will remain exposed to view shall receive field painting.
- E. The number of coats specified herein for various finishes is customarily sufficient to obtain satisfactory finish, but should such finish not be obtained, it shall be responsibility of Contractor to apply additional coats as may be required.
- F. Do not apply finishes to surfaces that are not dry.
- G. Apply each coat to uniform finish.
- H. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- I. Sand lightly between coats to achieve required finish.
- J. Allow applied coat to dry before next coat is applied.
- K. Where clear finishes are required:
 1. Tint fillers to match wood.
 2. Work fillers into the grain before set.
 3. Wipe excess from surface.
- L. For job-painted woodwork:
 1. Prime back of interior and exterior woodwork with primer.
- M. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- N. Behind Movable Equipment & Furniture:

1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
 2. Paint surfaces behind permanently-fixed equipment or furniture with only a prime coat before final installation of equipment.
- O. Ducts:
1. Where visible through registers or grilles, paint interior surfaces of ducts with a flat, non-specular black paint.
- P. Panels & Covers:
1. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
- Q. Concealed Spaces:
1. Unless otherwise indicated, painting is not required on walls and ceilings in concealed or generally inaccessible areas.
- 3.4 MECHANICAL AND ELECTRICAL EQUIPMENT
- A. General: Painting of mechanical and electrical equipment is limited to those items exposed in Mechanical Equipment rooms and in occupied spaces, unless otherwise noted.
- B. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, supports.
 2. Heat exchangers.
 3. Tanks.
 4. Ductwork, insulation.
 5. Motor, mechanical equipment, supports.
 6. Accessory items.
 7. Coordinate with Mechanical Work in Division 15 and Electrical Work in Division 16.
- C. Comply with current ANSI and applicable governing codes.
- D. Color Coding: Coordinate with Mechanical Work in Division 15, and Electrical Work in Division 16.
- E. Electrical items to be painted include, but are not limited to, the following:
1. Conduits and fittings.
- 3.5 SEALANT WORK
- A. Completely seal perimeters of door frames, window frames, storefront frames and view window frames with calking compound. Use exterior quality sealants to seal exterior side of frames. Comply with requirements of Section 07-9200 Building Joint Sealers.

END OF SECTION

SECTION 10-2123.13
CURTAIN AND I.V. TRACKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hospital cubicle curtain track and I.V. track systems.

1.2 QUALITY ASSURANCE

- A. For the purpose of designating the minimum aesthetic, functional and quality standards for the work of this Section, proprietary products are specified.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Clearly indicate:
 - a. Room or space layout and number to match Architect's drawings.
 - b. Lengths and quantities of cubicle tracks, with curtains and accessories required for installation in each room or space.
 - c. Details showing how track system is secured in place.
 - d. For seismic work, clearly indicate that the method of securing tracks is in compliance with local governing seismic requirements.
 - 2. Manufacturer's Product Data: Indicating all technical information which specifies full compliance with requirements of this Section.
 - 3. Samples:
 - a. 12" long samples of curtain track and I.V. track with carriers and finish representative of the specified items.
 - 4. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products manufactured by General Cubicle Co.
 - 1. Substitutions: The following manufacturers are acceptable. Other manufacturers are acceptable for evaluation only after compliance with Section 01-2513.
 - 1. Imperial Fastener Co., Inc., Pompano Beach, Florida
 - 2. A.R. Nelson, www.arnelson.com

2.2 CUBICLE TRACK SYSTEM

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- A. Cubicle Tracks: General Cubicles "General Carrier #1062N surface-mounted suspended tracks of heavy extruded aluminum alloy 6063-T4, 1-3/8" x 3/4", slotted to receive roller carriers, complete with accessories and components required for complete and secure installations including splicers, hanger tubing, end stops, and corner bends.
 - 1. Corner Bends: Shall have a 12" radius fabricated in one continuous "L" shape.
 - 2. Finish: Clear anodized aluminum.
- B. Carriers: General Cubicles, virgin nylon axle with nylon wheels.
 - 1. Provide nickel-plated brass bead-chain and hook assembly in typical areas.
 - 2. Provide Velcro tabs for Protective Environment applications.
 - 3. Provide one carrier for each 6 inches of cubicle curtain width.

2.3 I.V. TRACK SYSTEM

- A. Tracks: General Cubicles #17000 I.V. track of extruded aluminum alloy 6063-T4, 1-3/8" x 3/4", slotted to receive bottle holder assembly, complete with accessories and components required for complete and secure installations including splicers, pull-out, end stops and corner bends.
 - 1. Corner Bends: Shall have a 12" radius fabricated in one continuous "L" shape.
 - 2. Finish: Clear anodized aluminum.
- B. Bottle Holder Assembly: General Cubicles #17100, 5 Bottle I.V. Tree Holder Assembly with polished stainless steel 3/8" dia. rod main shaft, four 1/4" stainless steel folding arms, and nickel plated aluminum positive locking device.
 - 1. Stationary Hanger: Anodized aluminum tubing with aluminum ceiling socket and safety hook.
 - 2. Carriers: General Cubicles #17500 Twist-Lock Carriage, one-piece molded celcon body and 4 solid celcon wheels.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before starting track system work, verify site conditions are ready to receive tracks.
 - 1. Beginning of installation means acceptance of existing conditions.
- B. Install track systems in accordance with approved shop drawings and manufacturer's published recommendations.
- C. Attach track to ceiling suspension system and NOT to ceiling panels.
 - 1. Space screws at spacing recommended by cubicle track manufacturer.
 - 2. Track systems shall be capable of supporting 200 pound dead load.
- D. Align tracks horizontally and vertically.

END OF SECTION

SECTION 10-2227
PANEL FOLDING PARTITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Panel folding partition, top supported with fabric finish, complete with accessories and attachment.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Firm with a minimum five years experience in successfully producing accordion folding partitions similar to that specified.
- B. Installer: Shall be an authorized by accordion folding partition manufacturer.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Shop Drawings: Clearly indicate:
 - 1. Details of head and jambs.
 - 2. Structural support above ceiling.
 - 3. Stacking arrangement.
 - 4. Hardware and operating mechanism.
 - 5. Finish material.
- C. Manufacturer's Product Data: Clearly describing accordion folding partition system and performance.
- D. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
- E. Samples of fabric for review of color selection.

PART 2 - PRODUCTS

2.1 OPERABLE WALL

- A. Type: "600 Series" by Hufcor, www.hufcor.com
 - 1. Operation: Manually operated top-supported panels.
- B. Panels: 3" inch thick flat steel panel construction, 16 gage for STC 51 acoustical performance, welded to minimum 16 gage steel frames.
 - 1. Top of Panels: Reinforced to support suspension components.
 - 2. Panel Hinges: Continuous
 - 3. Panel Finish Material: Vinyl, FS CCC-W-408A, Type 1.
 - 4. Panel Edges and Seals: Interlocking vertical panel edges and operable seals shall be steel.
 - 5. Vinyl Color: To be selected by Architect from manufacturer's standard options.

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- C. Suspension System: Heavy-duty aluminum track supported by adjustable steel hanger rods complete with trolley assemblies.
 - 1. Trolley Assemblies: Radial type nylon tired, steel ball-bearing wheels, used to support panels with adjustable steel pendant bolts.

- D. Acoustical Performance: STC 54 required in accordance with ASTM E90.
 - 1. Vertical Seals Between Panels: Interlocking designed to prevent sound leaks.
 - 2. Vertical Astragal Seals: Vinyl.
 - 3. Horizontal Top Seals: Fixed top sweeps.
 - 4. Horizontal Bottom Seals: Retractable seals.

- E. Substitutions: Products of the following and other manufacturers are acceptable ONLY after compliance with Section 01-2513 and Architect's written approval.
 - 1. Panelfold, www.panelfold.com
 - 2. Modernfold Company, www.modernfold.com

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installing folding partitions, structural support and rough wood blocking work shall be complete.

- B. Install folding partitions in strict compliance with approved shop drawings and manufacturer's published instructions.

- C. Adjust folding partitions and hardware for smooth operation without binding.

- D. Leave folding partitions clean of soiled areas, undamaged and in operable condition.

END OF SECTION

SECTION 10-2623.13
IMPACT-RESISTANT WALL PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Corner guards, handrails and sheeting complete with accessories.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Firm with minimum five years experience in successfully producing corner guards/wall guards/handrails/accent rails similar to that indicated for this project.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Clearly indicate the following for each type of wall protector:
 - a. Type of wall protector identified by manufacturer's model numbers including profiles, sizes, accessories and finish.
 - b. Types and sizes of wall anchors for each type of wall construction.
 - 2. Samples: 6" long full size samples representative of each type of wall protector specified if requested by Architect.
 - 3. Manufacturer's certification indicating compliance with ADA Accessibility Guidelines for Protruding Objects and UL Classification in 2.1, B.
 - 4. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 MATERIALS/COMPONENTS/FABRICATION

- A. Manufacturer: Provide products manufactured by Construction Specialties Inc/Muncy, Pennsylvanian or approved substitution.
- B. Substitutions: The following manufacturers are acceptable. Other manufacturers are acceptable for evaluation only after compliance with Section 01-2513:
 - 1. Balco Inc/Wichita, Kansas.
 - 2. IPC Door and Wall Protection Systems/Muskego, WI.
 - 3. Pawling Corporation/Wassaic, NY.
- C. General: Model numbers identified are from "ACROVYN" Series.
 - 1. Each wall protector shall be manufactured from high-impact vinyl/acrylic extrusions, designed to absorb shock and resist marks and abrasions under impact.

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2. Color: As indicated on Finish Drawings, with each type of wall protector specified.
 3. Chemical/Stain Resistance: Shall comply with CSAV-280 standards.
- C. Fire Rating: Each type of wall assembly shall be UL Classified and have been tested in accordance with UL-723 (ASTM E84) to meet a flame spread of 25 or less, and smoke developed rating of 450 or less, to meet a Class 1 rating.
- D. Accessories: Each type of wall protector shall be complete with all accessories and attachments required to complete the assemblies including the following:
1. Retainers: Extruded aluminum full length of each wall protector.
 2. Wall Anchors and Mounting Brackets: Shall be types manufactured as part of wall protector system for substrate indicated on drawings. Other types are NOT acceptable.
 3. Accessory pieces such as end caps and similar items shall be of same finish as wall protector.
 4. Wall anchors in contact with pressure treated wood shall be of stainless steel.

2.2 CORNER GUARDS

- A. Guard Material: Extruded High Impact Vinyl/Acrylic, nominal .078" (1.98mm) thickness.
1. Chemical and stain resistance should be per ASTM D-1308
- B. Style/ Color: As indicated on Finish Drawing or approved substitute.

2.3 HANDRAILS

- A. Rail Material: Extruded High Impact Vinyl/Acrylic, nominal .078" (1.98mm) thickness.
1. Chemical and stain resistance should be per ASTM D-1308
- B. Retainers: Extruded aluminum retainers, 6063-T6 alloy, nominal .075" (1.90mm) thickness. Minimum strength and durability properties as specified in ASTM B221.
- C. Fasteners: Non-corrosive, compatible with aluminum retainers and fasteners to be supplied by the manufacturer.
- D. Style/Color: As indicated on Finish Drawing or approved substitute.

2.4 WALL PROTECTION

- A. Wall Covering: Semi-rigid vinyl, 0.40 inch thick with backing supplied in 54" x 20" yard rolls.
- B. Style Color: As indicated on Finish Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
1. Verify that existing conditions are ready to receive wall protectors.
 2. Beginning of work means acceptance of existing conditions.

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- B. Install wall protectors in accordance with approved shop drawings, manufacturer's published instructions, and ADA 4.4, 4.26 for size, mounting heights and structural strength.
- C. The completed assemblies shall be square, level and secure, accurately fitted and free from distortion and defects.

3.2 CLEANING

- A. Remove protective material from all wall protectors and clean in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 10-2813
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Toilet Accessories Legend and Description for types of toilet and related accessories scheduled, complete with attachment hardware. See Part 4.

1.2 QUALITY ASSURANCE

- A. For the purpose of designating the minimum aesthetic, functional, and quality standards for the work of this Section, proprietary products are specified.
- B. Toilet accessories shall comply with the most current regulations of the Americans with Disabilities Act (ADA). Provide certification of compliance to Architect, if requested.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Clearly indicate: Specimen box, and diaper changing station, configuration indicating type, weight of materials and finish.
 - 2. Schedule and product data for each type accessory required.
 - 3. Certification of compliance letter, if requested, as specified under Part 1.3.
 - 4. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened package bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Toilet and related accessories specified in this Section are based on products of Bobrick Washroom Equipment, www.bobrick.com
- B. Substitutions: Other the following and manufacturers may be submitted for evaluation in accordance with Section 01-2513:
 - 1. American Specialties Inc. www.americanspecialties.com
 - 2. The Bradley Corporation, www.bradleycorp.com

2.2 MATERIALS

- A. Stainless Steel Sheet: ASTM A167, commercial grade, 22 gage.
- B. Stainless Steel Tubing: ASTM A269, commercial grade, seamless welded.
- C. Adhesive: Epoxy type contact cement.
- D. Fasteners, Screws, and Bolts: Rust-resistant. Stainless steel for fastening into treated wood.

2.3 FABRICATION

- A. Joints: Welded and ground smooth.
- B. Exposed Surfaces: Formed from one sheet of stock, free of joints.
- C. Anchor Plates and Anchors: Hot-dipped galvanized for installation on building finishes.
- D. Surfaces: Formed flat without distortion, scratches or dents.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Deliver inserts and rough-in frames to jobsite at appropriate time for installation. Provide templates and rough-in measurements as required.
- B. Before starting work notify Architect in writing of any conflicts detrimental to installation or operation of units.
- C. Verify with Architect the exact location of any toilet and related accessories which are not clearly located in the Contract Documents.

3.2 INSTALLATION

- A. Install accessory items in accordance with manufacturer's instructions and ANSI and ADA requirements for handicap accessibility.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Use tamper-proof fasteners.
- D. Verify that recessed toilet accessories are not installed in rated walls/partitions.
- E. Caulk all recessed toilet accessories to the wall at walls designated as being "non-rated smoke-tight".

3.3 MOUNTING HEIGHTS FOR ACCESSORIES

TOILET ACCESSORIES 10-2813-3

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- A. Mounting heights above finish floor (A.F.F.) to top, bottom or centerline (CL) of accessory unit shall be as follows unless noted otherwise. Comply with Americans with Disabilities Act , CABO/ANSI A117.1 and other applicable accessibility codes for accessibility requirements.
1. See Enlarged Floor Plans for mounting heights.

PART 4 - TOILET ACCESSORIES LEGEND AND DESCRIPTION

4.1 ACCESSORIES

- A. WASTE RECEPTACLE: Bobrick B-279
1. Surface-mounted wall unit, open-top receptacle constructed entirely of 18-8 (Type 302), 22 gage stainless steel, satin finish on exposed surfaces.
 2. Liner: Vinyl type, removable for easy servicing.
 3. Capacity: 6.7 gallons
 4. Use: 1 in each public toilet.
- B. MOP AND BROOM HOLDER: Bobrick B-223
1. Size: 36" length, 4 holders.
 2. Surface-mounted unit constructed of 18-8 (Type 302) 22 gage stainless steel, satin finish.
 3. Holders: Spring-loaded rubber cam type.
 4. Use: 1 in each Janitor's closet.
- C. MIRROR WITHOUT SHELF: Bobrick B-290
1. Size: 18"x36"
 2. Frame: 18-8 (Type 304) heavy gage stainless steel, 3/4" x 3/4" angle, one-piece roll-formed construction, satin finish, complete with 20 gage galvanized steel back secured to frame with concealed screws and hangers.
 3. Corners of Frame: Heliarc welded, ground and polished smooth.
 4. Mirror: No. 1 quality, 1/4" float/plate glass, electrolytically copper plated, guaranteed for 15 years against spoilage.
 5. Edges and back of mirror shall be protected by full-size shock-absorbing, waterproof, non-abrasive polyethylene padding.
 6. Use: As indicated in Drawings.
- D. SINGLE ROBE HOOK: Bobrick B-671
1. Hook and Flange: 18-8 (Type 304) heavy gage stainless steel with stainless steel locking set screws.
 2. Concealed Wall Plate: 18-8 (Type 304), 18 gage.
 3. Finish: Satin.
 4. Use: As indicated in Drawings.
- E. GRAB BARS: Bobrick Series B-6806
1. Each type of grab bar scheduled below shall be designed and installed to meet ADA, Part 4.26.3 and the following requirements:
 2. Constructed of 18-8 (Type 304) stainless steel, satin finish.
 3. Grab Bar: 18 gage stainless steel, 1-1/2" outside diameter, 1-1/2" clearance from inside of grab bar to finished wall. Grab bars shall not rotate within their fittings.
 4. Flanges: Concealed mounting 1/8" thick, stainless steel plate, 3-1/8" diameter, 2 screw holes for attachment to wall.
 5. For stud walls, provide concealed anchor plates, length as required.

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6. Lengths: 18", 28", 30", 36", 42", 28" x 28" continuous, and 30" x 60" x 30" continuous.
 7. Use: As indicated in Drawings.
- F. GRAB BARS (Operable): Model 220-462 manufactured by Medical Products Direct, www.medicalproductsdirect.com
1. Stainless Steel Swingaway Bar swings out of the way when not in use.
 2. Lifting motion allows user to lock arm securely into any of the three positions 90 degrees apart.
 3. Ends: 14 gauge thick, 3" diameter ends with three mounting holes.
- G. SHOWER SEAT
1. Shower Seat: Bobrick 5181
 2. Mounting: Wall brackets (stainless steel)
 3. Seat: ½" thick solid phenolic, manufacturers standard color
 4. Frame: Stainless steel
 5. ADA Compliant
- H. SHOWER CURTAIN
1. Commercial 3' or 5' curved shower curtain rod constructed of one piece drawn tubing in heavy gauge stainless steel set on swivel brackets similar to Bradley Model at each shower.
- I. TOWEL BAR: Bobrick B-674
1. Size: 18" length
- J. TOILET TISSUE DISPENSER: Furnished by Owner.
- K. PAPER TOWEL DISPENSER: Furnished by Owner.
- L. SOAP DISPENSER: Furnished by Owner.
- 4.2 SPECIALIZED TOILET ACCESSORIES
- A. DIAPER CHANGING STATION
1. Type/Manufacturer: Rubbermaid No. 7818, Sturdy Station Changing Station with gusset support system with adjustable safety belt.
 - a. Rating: 50 pounds.
 - b. Size:
 - 1) 35-7/8" L x 28-1/4" W x 19-1/2" H open.
 - 2) 35-7/8" L x 28-1/4" W x 4" H closed.
 2. Color: White.
 3. Manufacturers: The following manufacturers are acceptable. Other manufacturers may be submitted for review in accordance with Section 01-2513:
 - a. Rubbermaid, www.rubbermaidforless.com
 - b. Diaper Deck, www.diaperdeck.com
 - c. Koala Kare Products, www.koalabear.com
 4. Locations: As indicated on Drawings.

TOILET ACCESSORIES 10-2813-5

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B. SPECIMEN BOX

1. Type/Manufacturer: SPB-1 as manufactured by Gamco, Durant, Oklahoma.
 - a. Acceptable Substitutions:
 - 1)Bradley #9813
 - 2)Bobrick #505

2. Construction:
 - a. All welded unit fabricated of Type 304 stainless steel with one piece seamless flange with 1/4" return for rigidity and mounting hole.
 - b. Doors: Extra heavy 18 gage, self closing doors, attached to frame with full-length concealed stainless steel piano hinge, equipped with pull knob.
 - c. Tray: Removable type.
 - d. Finish: Exposed surfaces satin finish.

END OF SECTION

SECTION 10-3107
ELECTRIC FIREPLACES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electric fireplace

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Manufacturer's Product Data: Indicating full compliance with requirements of this section; installation instructions.
- C. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.3 DELIVERY, HANDLING, STORAGE

- A. Product shall be delivered to job-site bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect product in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 ELECTRIC FIREPLACE

- A. Manufacturer: Provide products manufactured by Lennox Hearth, www.lennoxhearthproducts.com
 - 1. Substitutions: Products by the following manufacturers are acceptable:
 - a. Heat & Glo, www.heatnglo.com
 - b. Heatilator, www.heatilator.com
- B. Type: Model LSE-36R, Reflections Electric Fireplace
- C. Features:
 - 1. High-Definition Fire Vision for 3-D fire simulation
 - 2. Brick-lined firebox
 - 3. Wireless remote control
 - 4. Logs: "Split oak" log set
 - 5. Glowing ember bed
 - 6. Bi-fold glass doors: black finish

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7. Black finish on front.
8. No heater

PART 3 - EXECUTION

3.1 INSTALLATION

- B. Install fireplace in accordance with manufacturer's published recommendations.

END OF SECTION

SECTION 10-4413
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All fire extinguishers and fire extinguisher cabinets as indicated.
 - 1. Coordinate work of this Section with Mechanical Specification Sections.
- B. Lock Box for emergency rapid entry.

1.2 QUALITY ASSURANCE

- A. Provide portable fire extinguishers, cabinets and accessories by same manufacturer.
- B. Provide new portable fire extinguishers which are U.L. listed and bear U.L. "Listing Mark" for type, rating and classification of extinguisher indicated.
- C. Comply with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

1.2 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Submit product data, maintenance data, and installation details for each type of extinguisher required.
 - 2. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.3 DELIVERY, HANDLING AND STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Products specified in this Section are based on products of Potter-Roemer, www.potterroemer.com
- B. Products of the following manufacturers are acceptable. Other manufacturers may be submitted for evaluation in accordance with Section 01-2513.
 - 1. Larsen's Manufacturing, www.larsensmfg.com
 - 2. J.L. Industries, www.activarcpg.com/jl-industries/

2.2 FIRE EXTINGUISHER AND CABINET TYPES

A. FIRE EXTINGUISHER CABINET (FEC) (10 LB. ABC EXTINGUISHER)

1. Potter-Roemer, Inc. number 1724 semi-recessed, white baked enamel steel box with full acrylic panel door, containing and including the following by Potter-Roemer, Inc.
2. One (1) number 3010, 10 pound ABC multi-purpose dry chemical fire extinguisher, with U.L. rating of 4A:80B:C.
3. One (1) number 1961, Red Decal Lettering.
4. Exterior frame and door color: White

B. FIRE EXTINGUISHER (10 LB. ABC, WALL HUNG)(FE)

1. Potter-Roemer, Inc. number 3010, 10 pound ABC multi-purpose dry chemical, U.L. rating of 4A:80B:C.
2. Furnish complete with wall mounting bracket.
3. Uses: Utility type spaces as indicated on drawings.

2.3 LOCK BOX

- A. To comply with local ordinance requirements, provide exterior lock boxes for emergency rapid entry.
- B. Acceptable Manufacturers:
 1. Supra-Safe Key Box
 2. "Knox-Box Rapid Entry System," The Knox Company, Newport Beach, CA.
 3. "Bigger Combination Lock Box," The Keyless Lock Store, East Hills, NY.
- C. Quantity: 2 lock boxes.
- D. Locations: As indicated on the drawings.
- E. Label all keys properly.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Deliver inserts and rough-in frames to jobsite at appropriate time for installation. Provide templates and rough-in measurements as required.
- B. Verify rough openings for cabinets are correctly sized and located.
- C. Before starting work notify Architect in writing of any conflicts detrimental to installation or operation of units.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's instructions and to comply with applicable regulations of governing authorities.

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- B. Install square and plumb, and securely anchor mountings brackets and fire extinguisher cabinets to substrate per manufacturer's instructions.
- C. Upon installation employ a certified fire suppression contractor to inspect, certify, tag and date each fire extinguisher.
- D. Remove and replace damaged, defective or undercharged extinguishers.

3.3 CLEANING

- A. Remove protective material and clean in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 10-5113
METAL LOCKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal lockers complete with hardware and accessories.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Firm with minimum five years experience in successfully producing metal lockers similar to that indicated for this project.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop Drawings: Clearly indicate the following:
 - a. Plan layout and elevations of groups of lockers.
 - b. Locker type and size.
 - c. Installation details.
 - d. Accessories.
 - e. Numbering plan.
 - f. Color and finish.
 - 2. Product Data: Describing locker construction, materials, and components.
 - 3. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.
 - 4. Samples: For color selections.

1.4 DELIVERY AND STORAGE

- A. Do not deliver lockers to jobsite until building conditions are adequate to receive this locker work.
- B. Store and protect lockers under provisions of Section 01-6500.
- C. Protect locker finishes and adjacent surfaces from damage during installation.

PART 2 - PRODUCTS

2.1 LOCKERS

- A. Manufacturer: Republic Storage Systems LLC, www.republicstorage.com
- B. Substitutions: Products of the following and other manufacturers are acceptable only after compliance with substitution requirements specified in Section 01-2513 and Architect's written approval:
 - 1. Lyonworkspace Products, www.lyonworkspace.com
 - 2. Penco Products Incorporated, www.pencoproducts.com
- C. Type: Standard painted steel construction of quality specified in this section:
 - 1. Double Tier: 12" Wide, 15" Deep, 72" high each

2. Purse: 12" W by 15" D, 12" H
3. Full Height: 12" Wide, 12" Deep, 72" high each
4. Locations: As indicated on drawings.

2.2 MATERIALS AND FABRICATION

- A. Sheet Steel: Mild cold-rolled sheet steel, free from imperfections. All edges shall have smooth finish.
- B. Bodies: Formed and flanged with stiffener ribs; electrically spot welded; 24 gage sheet steel.
- C. Door Frame: Shall be 16 gage, 1" face channel shape with continuous vertical door strike integral with the frame on both sides of door opening. Cross frames, 16 gage channel shape, including intermediate cross frame on double tier lockers welded to vertical framing members.
- D. Doors: 16 gage steel, full channel shape on the lock side to fully conceal the lock bar, channel shape on hinge side and right angle shape across top and bottom. Provide louvers in face of each door.
- E. Hinges: 5-knuckle, full loop, tight pin style welded securely to frame and riveted to inside of the door flange.
 1. For Doors 42" and Higher: 3 hinges required.
 2. For Doors Under 42": 2 hinges required.
- F. Locks: Provide locking handle for padlock to be supplied by Owner.
- G. Base: Front and end, 16 gage zee base, 4" high.
- H. Tops: Sloped 24 gage sheet steel.
- I. Recessed Trim: 18 gage, 3" face with 3/8" top return for use when lockers are completely recessed.
- J. Boxed end panels and filler panels to close off all openings.
- K. Number Plates: One required for each locker.

2.3 FINISHES

- A. Clean, degrease, and neutralize metal; prime and finish with two coats of baked enamel.
- B. Color: To be selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lockers secure, plumb, square in accordance with approved shop drawings.

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- B. Anchor lockers in place with appropriate anchor devices to suit materials encountered.
- C. Bolt adjoining locker units together to provide rigid installation.
- D. The completed locker installation shall be complete with specified accessories. Unless indicated otherwise, install metal end panels and filler panels to completely close off openings.

END OF SECTION

SECTION 10-7500
FLAGPOLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Prefabricated aluminum flagpoles.

1.2 QUALITY ASSURANCE

- A. Flagpole shall be manufactured and furnished as a complete unit by one firm able to demonstrate a minimum of five years successful experience in work of this nature.
- B. Erection shall be performed by an approved installer.
- C. Flagpole and installation shall be constructed to withstand a 120 mph wind velocity minimum when flying flag of appropriate size.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Shop drawings clearly indicating:
 - a. Overall dimensions of flagpole and base.
 - b. Installation and anchoring details.
 - c. Materials and finishes.
 - 2. Manufacturer's Product Data: Indicating technical data and installation instructions.
 - 3. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site wrapped in heavy protective wrapping bearing manufacturer's labels in accordance with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 FLAGPOLE

- A. Flagpole shall be cone tapered aluminum fabricated from seamless extruded tubing complying with ASTM B241 alloy 6063-T6, having a minimum wall thickness of 3/16", tensile strength not less than 30,000 psi, yield point of 25,000 psi. Heat-treat and age-harden after fabrication.
- B. Manufacturer: Products of Baartol Co., Inc. are acceptable. Other manufacturers are acceptable for review only after compliance with Section 01-2513.

2.2 MOUNTING

- A. Provide manufacturer's standard base system for type of flagpole installation required.
- B. Foundation Tube: 16 gage minimum galvanized corrugated steel tube, sized to suit flagpole and installation.
 - 1. Furnish with welded steel bottom base and support plate, lighting ground spike, and steel centering wedges, all welded construction.

2.3 HEIGHT

- A. Exposed Height: 30 feet

2.4 FINISH

- A. Fine, directional, mechanical satin polish with following finish:
 - 1. Natural clear, anodized finish, NAAMM - C22A41, Class I (0.7 mil).

2.5 ACCESSORIES

- A. Finial Ball: Manufacturer's standard flush seam ball.
 - 1. Size to match pole butt diameter.
 - 2. Finish: 14 gage spun aluminum to match pole shaft.
- B. Truck: Ball-bearing non-fouling, revolving, double-track assembly, cast metal, finished to match pole shaft.
- C. Cleats: Two 9" cast metal with fasteners, match finish of pole shaft.
- D. Halyards: Two (2) external continuous halyards, nylon, braided with metal core.
 - 1. Size: 3/8" (No. 12).
- E. Halyard Flag Snaps: Two (2) swivel snaps per halyard, bronze.
- F. Sealant: As specified in Section 07-9200.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Excavation: Excavate to neat clean lines in undisturbed soil. Provide forms where required due to unstable soil conditions. Remove foreign matter from excavation, and moisten earth before placing concrete.
- B. Concrete: Portland cement, coarse and fine aggregate and water, mixed in proportions to attain 28-day compressive strength of not less than 3000 psi, complying with ASTM C94.
 - 1. Place concrete immediately after mixing. Avoid segregation of mix. Compact concrete in place. Moist-cure for not less than 7 days.
 - 2. Finish trowel exposed concrete surfaces to smooth, dense surface. Provide positive slope for water runoff to base perimeter.

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- C. Flagpole Installation: Install flagpoles as shown and in compliance with final shop drawings and manufacturer's instructions.
 - 1. Provide positive lightning ground for each flagpole installation.
 - 2. Apply protective coating to surfaces which will be in contact with cementitious materials.

END OF SECTION

SECTION 11-5213
PROJECTION SCREENS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manually-operated projection screens complete with accessories.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Obtain projection screen from a single manufacturer as a complete unit, including mounting hardware and accessories.
- B. Mildew Resistance: Provide mildew resistant screen fabrics as determined by FS 191A/5760.
- C. Fire Performance Characteristics: Provide projection screen fabrics which have undergone testing and passed requirements for flame resistance per local governing regulations.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01-3323.
- B. Shop Drawings: Clearly indicate method of securing each type of projection screens in place.
- C. Manufacturer's Product Data: Indicating full compliance with requirements of this section; installation instructions.
- D. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, HANDLING, STORAGE

- A. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels.
 - 1. Comply with Section 01-6500.
- B. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.
- C. Do not deliver projection screens to job-site until suspended ceilings and other types of ceilings are complete and approved.
- D. Products shall be delivered to job-site in original unopened packages bearing manufacturer's labels in accordance with Section 01-6500.
- E. Store and protect products in accordance with manufacturer's recommendations and Section 01-6600.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. General: Projection screens specified shall be complete with requirements of this section and accessories for complete installations, as manufactured by Da-Lite Screen Company Inc/Warsaw, Indiana.
- B. Substitutions: The following manufacturers are acceptable. Other manufacturers are acceptable for evaluation only after compliance with Section 01-2513.
 - 1. Draper Screen Company Inc/Spiceland, Indiana.

2.2 MANUAL PROJECTION SCREEN

- A. Type: Manual projection screen of the following type manufactured by Da-Lite, approved by Underwriters Laboratories (UL), complete with UL identification marks.
 - 1. Model "C" Unit:
 - a. 72-inches H by 72-inches W.
 - 2. Mounting Type: Flush mounting, recessed above ceiling, door to be painted same color as ceiling.
- B. Screen: Shall have a heavy gage case with flat-back design with baked enamel finish and fitted with heavy-duty chrome plated steel case end caps concealing roller ends with integral bearing surface or steel inner caps to support roller, complete with mounting.
 - 1. Type of Fabric: Matte white
 - 2. Bottom of Fabric: Shall be mounted into a metal strip in a tubular steel slat finished in baked enamel.
 - 3. Ends of Slats: Plated steel attached to slat with screws.
 - 4. Slat Pulls: Plated steel attached to slat with screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Verify that existing conditions are ready to start projection screen work.
 - 2. Beginning of projection screen work means acceptance of existing conditions.
- B. Install projection screens in accordance with approved shop drawings and manufacturer's published instructions.
- C. Upon completion of Work, projection screens shall be in operable condition, and in clean and unmarred condition.

END OF SECTION

SECTION 13-4900
RADIATION PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sheet lead.
- B. Furnish the following items to be installed by others:
 - 1. Lead-lined gypsum board, Section 09-2116
 - 2. Lead discs and lead strips, Section 09-2116
 - 3. Sheet lead for door hardware, Section 08-7100
 - 4. Lead glass for view windows, Section 08-8100
 - 5. Leaded doors and door frames, Section 08-1400 and 08-1113.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Firm with a minimum of ten years experience in successfully producing radiation protection products similar to that specified.

1.3 SUBMITTALS

- A. Follow Section 01-3323 for making construction submittals.
 - 1. Manufacturer's Product Data: Illustrating equipment items and describing radiation protection items.
 - 2. Manufacturer's Published Instructions: Describing installation of view windows and film loading cabinet.
 - 3. Letter of Certification that items used within this section meet the Recovery and Reinvestment Act (ARRA) requirements as specified in Section 01-1100.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Comply with sections 01-6500 and 01-6600.
- B. Do not deliver items to project site until they can be installed promptly.
- C. Deliver items in original, resealed containers and leave protective packaging in place until items can be installed. Dispose of damaged items that cannot be properly repaired for installation.
- D. Handle materials carefully.
- B. Strictly follow Manufacturer's instructions for storing.

1.5 COORDINATION

- E. Coordinate work with other trades involved in this work.

- C. Deliver lead-lined gypsum board and associated items to wallboard trade so as to cause no delay in the work.
- D. Deliver sheet lead to hardware installer to expedite this work.
- E. Install view window, and cassette film loading cabinet in close coordination with wallboard trade.
- F. Install sheet lead at electrical outlets, switch boxes, utility recesses, and other penetrations of lead-lined walls in close coordination with mechanical and electrical trades.

1.6 TESTING

- A. After X-ray equipment has been installed and placed in operation, have radiation shielding tested by a health physicist who is certified by a nationally recognized agency. Owner will pay for testing. Decision of acceptability of shielding by the health physicist shall be binding.
- B. Method of Testing: In accordance with requirements of National Bureau of Standards Handbook H-76 "Medical X-Ray Protection up to Three Million Volts".
- C. Repair or replace defective work including other affected work. Do any additional testing required for the health physicist's satisfaction. Repair, replacement and retesting shall be at contractor's expense.

PART 2 - PRODUCTS

2.1 PRODUCTS/MANUFACTURER

- A. The following products/manufacturers are acceptable only after compliance with Section 01-2513.

2.2 LEAD SHIELD MATERIALS

- A. Acceptable Manufacturers:
 - 1. New Shield, Inc., Stony Point, NY (845) 947-4711.
 - 2. Ray Bar Engineering, Azusa, CA (877) 909-1818.
 - 3. Sand S Technology, Houston, TX (800) 231-1747.
- B. Lead-Lined Gypsum Board: 5/8" thick x 4'-0" wide x height indicated, laminated with a single sheet of pure virgin lead of thickness indicated. Gypsum board shall be Firecode C (Type X) only.
- C. Sheet Lead: Unpierced, pure virgin lead, varying not more than 3% over entire surface complying with FS QQL-201F, Grade #33, #35.
 - 1. Lead Discs: 1/16" thick x 1" diameter, to cover screw heads.
 - 2. Lead Strips: 2" wide x height and thickness indicated for lead lined gypsum board.

3. Shields: 1/16" thick x dimensions required for shielding electrical outlets, switch boxes, utility recesses, and other penetrations of lead-lined walls.
 4. Hardware Shields: 1/16" thick x dimensions required to shield door hardware.
- D. Lead Glass for Viewing Window Frame Specified in Section 08-8100.
1. Match lead lining of frame to that of surrounding wall lead.
 2. Leaded glass, approximately 1/4" thick; install multiple panes to provide shielding equal to lead of surrounding wall lead.

PART 3 - EXECUTION

3.1 INSTALLING

- A. Install viewing window glass cabinet strictly in accordance with manufacturer's printed instructions.
- B. Install sheet lead shields to cover wall penetrations and extend out at least 2" in all directions. Attach lead securely to retain it in place but do not penetrate lead with fasteners.
- C. Control windows shall be installed with center at 5'-3" above finish floor. (The code requires a minimum of 18 inches from edge of glass to end of control wall.)

END OF SECTION

SECTION 21-0500
FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This project is expected to be funded in whole or in part using funds from the American Recovery and Reinvestment Act (ARRA). Section 1605 of the ARRA prohibits the use of these funds unless all iron, steel, and manufactured goods are produced in the United States. All iron and steel manufacturing processes must take place in the United States, except for metallurgical processes involving refinement of steel additives. There is no requirement for the origin of components and subcomponents of manufactured goods. Products listed at 48 CFR 25.104(a) have been determined to be unavailable in the United States and if required for the project may be purchased from foreign sources. No unauthorized use of foreign iron, steel, and/or manufactured goods will be allowed on this project
- B. This Section includes the following fire-suppression piping inside the building:
 - 1. Automatic wet-type, Class I standpipe systems.
 - 2. Wet-pipe sprinkler systems.
- C. Related Sections include the following:
 - 1. Division 2 Section "Water Distribution" for piping outside the building.
 - 2. Division 10 Section "Fire-Protection Specialties" for cabinets and fire extinguishers.
 - 3. Division 13 Section "Fire Alarm" for alarm devices not specified in this Section.

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig.
- D. PE: Polyethylene plastic.
- E. Underground Service-Entrance Piping: Underground service piping below the building.

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1.4 SYSTEM DESCRIPTIONS

- A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.
- B. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
- C. Dry-pipe system: Sprinklers are attached to pipes that contain pressurized air. When heat activates the sprinklers, the air pressure is reduced, allowing the dry-pipe valve to open (or trip) and water to flow to the sprinklers.
- D. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. High-Pressure Piping System Component Working Pressure: Listed for 250 psig minimum.
- C. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.
 - 1. Minimum residual pressure at each hose-connection outlet is the following:
 - a. NPS 1-1/2 Hose Connections: 65 psig.
 - b. NPS 2-1/2 Hose Connections: 100 psig.
 - 2. Unless otherwise indicated, the following is maximum residual pressure at required flow at each hose-connection outlet:
 - a. NPS 1-1/2 Hose Connections: 100 psig.
 - b. NPS 2-1/2 Hose Connections: 175 psig.
- D. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.

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- c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - e. Office and Public Areas: Light Hazard.
 - f. Patient Rooms: Light Hazard.
3. Minimum Density for Automatic-Sprinkler Piping Design:
- a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
 - d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
 - e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
 - f. Special Occupancy Hazard: As determined by authorities having jurisdiction.
4. Maximum Protection Area per Sprinkler:
- a. Office Spaces: 225 sq. ft..
 - b. Storage Areas: 130 sq. ft..
 - c. Mechanical Equipment Rooms: 130 sq. ft..
 - d. Electrical Equipment Rooms: 130 sq. ft..
 - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
- a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
 - c. Extra-Hazard Occupancies: 500 gpm for 90 to 120 minutes.
- E. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads." See Structural drawings for Seismic Design Category based on International Building Code.

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1. In Victaulic grooved piping systems, seismic motion shall be accommodated by installing swing joints consisting of flexible couplings, pipe nipples and elbows that provide simultaneous movement in all directions, or other seismic movement compensation devices such as loops, offsets, or Style 155 expansion joints when in-line device is required, to provide flexibility to the system and help reduce pipe stresses. Refer to Victaulic design submittal #26.12.

1.6 SUBMITTALS

- A. Product Data: For the following:
 1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
 2. Pipe hangers and supports, including seismic restraints.
 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 5. Hose connections, including size, type, and finish.
 6. Monitors.
 7. Alarm devices, including electrical data.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Fire-hydrant flow test report.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.
 1. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable Victaulic style or series number.
 2. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification number (SIN#) and model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Welding certificates.

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- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.
- I. Provide three sets of As-Built Record Drawings indicating actual installed locations, sizes and types of sprinkler heads, piping, valves, supports, equipment and all other system components. Identify all deviations from approved submittal drawings. Provide two sets of final hydraulic calculations and ACAD 2000 edition discs of As-Built Drawings.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- C. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.
- D. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Coordinate all pipe routing with all trades to avoid any routing problems during installation of all systems located above ceiling.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CPVC PIPE

- A. The material used in the manufacture of the pipe shall be a rigid chlorinated polyvinyl chloride (CPVC) compound, Type IV Grade I, with a Cell Classification of 23547 as defined in ASTM D1784. The compound and the finished product shall be orange in color, and shall be approved by the National Sanitation Foundation (NSF) for use with potable water. Material used shall be domestically produced BlazeMaster CPVC material as provided by Noveon, Inc. (formerly the BFGoodrich Company).

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.
 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Cetral Sprinkler Corp.
 - 3) Grinnell Fire Protection.
 - 4) Star Pipe Products; Star Fittings Div.
 - 5) Victaulic Co.
 - b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD supplied with factory grooved ends designed to accept Victaulic couplings.
 - c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, pressure-responsive, synthetic rubber gasket with center leg (FlushSeal®), and steel bolts and nuts. Victaulic Style 31.

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- d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing cast with offsetting, angle-pattern bolt pads, with key matching ductile-iron-pipe groove and key matching steel-pipe groove, pressure-responsive, synthetic rubber gasket listed for use with housing, and steel bolts and nuts. Victaulic Style 307.
- e. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with pressure-responsive, synthetic rubber gasket listed for use with housing and steel bolts and nuts. Victaulic Style 341.

2.4 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.
 - 1. Cast-Iron Threaded Flanges: ASME B16.1.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4.
 - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
 - 5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.
 - 1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Ward Manufacturing.
- C. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.

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D. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, square-cut- or roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

- 1) Anvil International, Inc.
- 2) Cetral Sprinkler Corp.
- 3) Grinnell Fire Protection.
- 4) Star Pipe Products; Star Fittings Div.
- 5) Victaulic Co.

b. Grooved-End Fittings: UL-listed, FMG approved, ASTM A 536, ductile-iron casting (FireLock®), ASTM A234 forged steel, or ASTM A53 fabricated steel with OD matching steel-pipe OD, with factory grooved ends designed to accept Victaulic couplings.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated pressure-responsive, synthetic rubber gasket listed for use with housing, and steel bolts and nuts.

1. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be permitted if a torque wrench is used for installation. Required torque shall be in accordance with the manufacturer's current listed standards.

a) 1-1/4" through 4": "Installation Ready" rigid joints, designed for direct "stab" installation onto grooved end pipe without prior disassembly of the coupling. Victaulic FireLock® EZ Style 009.

b) 5" and Larger: Standard rigid joints equal to Victaulic FireLock® Style 005 or Style 07 Zero-Flex®.

2. Flexible Type: Use in seismic areas where required by NFPA 13. Victaulic Style 75 or 77.

3. Gaskets for grooved-end-pipe couplings shall be listed for use with the housings as follows:

Fire Protection Service	Temperature Range	Gasket Recommendation
Dry Systems	Ambient	FlushSeal®, Grade EPDM,

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		Type A
Freezer Applications	-40°F to 0°F	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	Grade EPDM, Type A

- d. Grooved-End-Pipe Flange Adapters: UL-listed, FMG approved, ASTM A536, ductile-iron casting, flat face, for mating directly to ANSI Class 125 and 150 flanged components. Victaulic Style 741 or 744.
- E. Threaded-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe; hot-dip galvanized where indicated and with factory- or field-threaded ends.
 - 1. Cast-Iron Threaded Flanges: ASME B16.1.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4.
 - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
 - 5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
- F. Plain-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe hot-dip galvanized where indicated.
 - 1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Ward Manufacturing.
- G. Plain-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe hot-dip galvanized where indicated.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.

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H. Grooved-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe hot-dip galvanized where indicated; with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

- 1) Anvil International, Inc.
- 2) Cetral Sprinkler Corp.
- 3) Grinnell Fire Protection.
- 4) Star Pipe Products; Star Fittings Div.
- 5) Victaulic Co.

b. Grooved-End Fittings: UL-listed, FMG approved, ASTM A 536, ductile-iron casting (FireLock®), ASTM A234 forged steel, or ASTM A53 fabricated steel with OD matching steel-pipe OD, with factory grooved ends designed to accept Victaulic couplings.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated pressure-responsive, synthetic rubber gasket listed for use with housing, and steel bolts and nuts.

1. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be permitted if a torque wrench is used for installation. Required torque shall be in accordance with the manufacturer's current listed standards.

a) 1-1/4" through 4": "Installation Ready" rigid joints, designed for direct "stab" installation onto grooved end pipe without prior disassembly of the coupling. Victaulic FireLock® EZ Style 009.

b) 5" and Larger: Standard rigid joints equal to Victaulic FireLock® Style 005 or Style 07 Zero-Flex®.

2. Flexible Type: Use in seismic areas where required by NFPA 13. Victaulic Style 75 or 77.

3. Gaskets for grooved-end-pipe couplings shall be listed for use with the housings as follows:

Fire Service	Protection	Temperature Range	Gasket Recommendation
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Dry Systems	Ambient	FlushSeal®, Grade EPDM, Type A
Freezer Applications	-40°F to 0°F	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	Grade EPDM, Type A

- d. Grooved-End-Pipe Flange Adapters: UL-listed, FMG approved, ASTM A536, ductile-iron casting, flat face, for mating directly to ANSI Class 125 and 150 flanged components. Victaulic Style 741 and 744.

- I. Threaded-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10, and with factory- or field-formed threaded ends.
 - 1. Cast-Iron Threaded Flanges: ASME B16.1.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4.
 - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe.
 - 5. Steel Threaded Couplings: ASTM A 865.

- J. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10.
 - 1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Ward Manufacturing.

- K. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.

- L. Grooved-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10, and with factory- or field-formed, roll-grooved ends.
 - 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Cetral Sprinkler Corp.
 - 3) Grinnell Fire Protection.

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- 4) Star Pipe Products; Star Fittings Div.
 - 5) Victaulic Co.
- b. Grooved-End Fittings: UL-listed, FMG approved, ASTM A 536, ductile-iron casting (FireLock®), ASTM A234 forged steel, or ASTM A53 fabricated steel with OD matching steel-pipe OD, with factory grooved ends designed to accept Victaulic couplings.
- c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated pressure-responsive, synthetic rubber gasket listed for use with housing, and steel bolts and nuts.
- 1. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be permitted if a torque wrench is used for installation. Required torque shall be in accordance with the manufacturer's current listed standards.
 - a) 1-1/4" through 4": "Installation Ready" rigid joints, designed for direct "stab" installation onto grooved end pipe without prior disassembly of the coupling. Victaulic FireLock® EZ Style 009.
 - b) 5" and Larger: Standard rigid joints equal to Victaulic FireLock® Style 005 or Style 07 Zero-Flex®.
 - 2. Flexible Type: Use in seismic areas where required by NFPA 13. Victaulic Style 75 or 77.
 - 3. Gaskets for grooved-end-pipe couplings shall be listed for use with the housings as follows:

Fire Protection Service	Temperature Range	Gasket Recommendation
Dry Systems	Ambient	FlushSeal®, Grade EPDM, Type A
Freezer Applications	-40°F to 0°F	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	Grade EPDM, Type A

- d. Grooved-End-Pipe Flange Adapters: UL-listed, FMG approved, ASTM A536, ductile-iron casting, flat face, for mating directly to ANSI Class 125 and 150 flanged components. Victaulic Style 741 and 744.

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- M. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10.
 - 1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Ward Manufacturing.
- N. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10.
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- O. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends.
 - 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Cetral Sprinkler Corp.
 - 3) Grinnell Fire Protection.
 - 4) Star Pipe Products; Star Fittings Div.
 - 5) Victaulic Co.
 - b. Grooved-End Fittings: UL-listed, FMG approved, ASTM A 536, ductile-iron casting (FireLock®), ASTM A234 forged steel, or ASTM A53 fabricated steel with OD matching steel-pipe OD, with factory grooved ends designed to accept Victaulic couplings.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated pressure-responsive, synthetic rubber gasket listed for use with housing, and steel bolts and nuts.
 - 1. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be permitted if a torque wrench is used for installation.

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Required torque shall be in accordance with the manufacturer's current listed standards.

- a) 1-1/4" through 4": "Installation Ready" rigid joints, designed for direct "stab" installation onto grooved end pipe without prior disassembly of the coupling. Victaulic FireLock® EZ Style 009.
 - b) 5" and Larger: Standard rigid joints equal to Victaulic FireLock® Style 005 or Style 07 Zero-Flex®.
2. Flexible Type: Use in seismic areas where required by NFPA 13. Victaulic Style 75 or 77.
 3. Gaskets for grooved-end-pipe couplings shall be listed for use with the housings as follows:

Fire Protection Service	Temperature Range	Gasket Recommendation
Dry Systems	Ambient	FlushSeal®, Grade EPDM, Type A
Freezer Applications	-40°F to 0°F	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	Grade EPDM, Type A

- d. Grooved-End-Pipe Flange Adapters: UL-listed, FMG approved, ASTM A536, ductile-iron casting, flat face, for mating directly to ANSI Class 125 and 150 flanged components. Victaulic Style 741 and 744.

2.5 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper; with plain ends.
 1. Copper fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 2. Brazing Filler Metals: AWS A5.8, BCuP-3 or BCuP-4.
- B. Plain-End, Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.
 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

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2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match tubing system.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket metal-to-metal seating surfaces, and solder-joint or threaded ends.
 4. Delete first subparagraph and associated subparagraphs below if not permitted.
 5. Brazing Filler Metals: AWS A5.8, BCuP-3 or BCuP-4.
- C. Grooved-End, Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper; with factory- or field-formed, roll-grooved ends.
1. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.
 - a. Manufacturers:
 - 1) T-Drill Industries, Inc.
 2. Grooved-Joint Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Cetral Sprinkler Corp.
 - 3) Grinnell Fire Protection.
 - 4) Star Pipe Products; Star Fittings Div.
 - 5) Victaulic Co.
 - b. Grooved-End Copper Fittings: ASTM B 75, copper tube, ASTM B 152 wrought copper, or ASTM B 584, bronze casting. Fittings shall be manufactured to copper tube dimensions. Flaring of tube and fitting ends to IPS dimensions is not permitted. Fittings shall be supplied with factory grooved ends designed to accept Victaulic couplings.
 - c. Grooved-End-Tube Couplings: UL 213, rigid pattern, unless otherwise indicated; gasketed fitting equivalent to AWWA C606, but made to match copper-tube OD. "Installation Ready" stab-on design for installation without prior field disassembly. Include ductile-iron housing cast with offsetting, angle-pattern bolt pads, coated with copper-colored enamel, with keys matching steel-pipe and fitting grooves, pressure-responsive, synthetic rubber gasket, listed for use with housing, and steel bolts and nuts. . Victaulic Style 607 "QuickVic".
 - d. Grooved-End-Flange-Adapters: ASTM A536 ductile-iron casting coated with copper-colored enamel. Manufactured for engaging directly into

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copper tubing sized roll grooved copper tube and fittings and bolting directly to ANSI Class 125 and 150 flanges. Victaulic Style 641.

2.6 CPVC PIPING

- A. Tyco BlazeMaster thermoplastic CPVC or equal:
 - 1. Pipe: ASTM F442, SDR 13.5
 - 2. Fittings: ASTM F438 (schedule 40) ASTM F439 (schedule 80, ASTM F1970)

2.7 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.
- B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Hart Industries International, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Industries, Inc.; Wilkins Div.
- C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:

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- a. Advance Products and Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
- E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.
- 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- F. Dielectric Nipples: Electroplated steel or ductile iron with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 225 deg F. Victaulic Style 47.
- 1. Manufacturers:
 - a. Perfection Corporation.
 - b. Victaulic Co.

2.8 FLEXIBLE CONNECTORS

- A. Flexible connectors shall have materials suitable for system fluid. Include 300-psig minimum working-pressure rating and ends according to the following:
- 1. NPS 2 and Smaller: Threaded.
 - 2. NPS 2-1/2 and Larger: Flanged.
 - 3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.
- B. Manufacturers:
- 1. Anamet Inc.
 - 2. Flex-Hose Co., Inc.
 - 3. Flexicraft Industries.
 - 4. Flex-Pression, Ltd.
 - 5. Flex-Weld, Inc.
 - 6. Mercer Rubber Co.
 - 7. Metraflex, Inc.
 - 8. Unaflex Inc.
- C. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

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- D. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- E. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.
- F. Victaulic Style 177 or 77 flexible couplings may be used in lieu of flexible connectors at equipment connections. Three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.

2.9 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 250-psig minimum working-pressure rating if fittings are components of high-pressure piping system.
- B. Outlet Specialty Fittings:
 - 1. Manufacturers:
 - a. Victaulic Co.
 - 2. Mechanical-T® and -Cross Fittings: UL 213, ductile-iron housing with pressure-responsive, synthetic rubber gaskets, bolts and nuts, and threaded, or grooved outlets. Victaulic Style 920/920N.
 - 3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet. Victaulic Style 923 and 924.
- C. Sprinkler Drain and Alarm Test Fittings: Cast-or ductile-iron, or bronze body; with threaded, grooved, or locking-lug inlet and outlet, test valve, and orifice and sight glass. Victaulic Style 720 TestMaster II.
 - 1. Manufacturers:
 - a. Fire-End and Croker Corp.
 - b. Viking Corp.
 - c. Victaulic Co.
- D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
 - 1. Manufacturers:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire-End and Croker Corp.
 - c. Potter-Roemer; Fire-Protection Div.

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E. Sprinkler Inspector's Test Fitting: Cast-or ductile-iron, or bronze housing with threaded or grooved inlet and drain outlet and sight glass. Victaulic Style 720 TestMaster II.

1. Manufacturers:

- a. AGF Manufacturing Co.
- b. G/J Innovations, Inc.
- c. Triple R Specialty of Ajax, Inc.
- d. Victaulic Co.

F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers:

- a. CECA, LLC.
- b. Merit.

2.10 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.

B. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. NPS 1-1/2 and Smaller: Bronze or brass body with threaded or grooved ends.

2. NPS 2 and NPS 2-1/2: Bronze or brass body with threaded or grooved ends or ductile-iron body with grooved ends.

3. NPS 3: Ductile-iron body with grooved ends.

4. Manufacturers:

- a. NIBCO.
- b. Victaulic Co. Series 728 FireLock®

C. Butterfly Valves: UL 1091.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers:

- 1) Global Safety Products, Inc.
- 2) Milwaukee Valve Company.

2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

- 1) McWane, Inc.; Kennedy Valve Div.
- 2) Mueller Company.

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- 3) NIBCO.
 - 4) Pratt, Henry Company.
 - 5) Victaulic Co. Series 705W FireLock®
- D. Check Valves NPS 2 and Larger: UL 312, swing or spring-actuated type, cast-or ductile-iron body with flanged or grooved ends.
1. Manufacturers:
 - a. AFAC Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Globe Fire Sprinkler Corporation.
 - e. Mueller Company.
 - f. NIBCO.
 - g. Potter-Roemer; Fire Protection Div.
 - h. Reliable Automatic Sprinkler Co., Inc.
 - i. United Brass Works, Inc.
 - j. Venus Fire Protection, Ltd.
 - k. Victaulic Co. Series 717 FireLock®
 - l. Watts Industries, Inc.; Water Products Div.
- E. Gate Valves: UL 262, OS&Y type.
1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) NIBCO.
 - 4) United Brass Works, Inc.
 2. NPS 2-1/2 and Larger: Cast-or ductile-iron body with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Clow Valve Co.
 - 2) Crane Co.; Crane Valve Group; Crane Valves.
 - 3) Crane Co.; Crane Valve Group; Jenkins Valves.
 - 4) Milwaukee Valve Company.
 - 5) Mueller Company.
 - 6) NIBCO.
 - 7) Red-White Valve Corp.
 - 8) United Brass Works, Inc.
 - 9) Victaulic Co. Series 771 FireLock®
- F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch Visual.

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2. NPS 2 and Smaller: Ball or butterfly valve with brass or bronze body and threaded or grooved ends.
 - a. Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) NIBCO.
 - 3) Victaulic Co. Series 728 FireLock®

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) NIBCO.
 - 3) Victaulic Co. Series 705W FireLock®

2.11 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 and Smaller:

1. MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
2. Meets the intent of MSS SP-110, 2-piece forged brass body with chrome-plated brass ball and stem 300-psig (2065-kPa) maximum CWP rating, blowout-proof stem, and Pressfit® ends. Victaulic Series 522.

B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.12 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating. Control valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.

1. Manufacturers:

- a. AFAC Inc.
- b. Globe Fire Sprinkler Corporation.
- c. Victaulic Co.
- d. Viking Corp.

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2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze or brass grooved seat with nitrile O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer. Valve internal parts shall be replaceable without removing the valve from the installed position. Victaulic FireLock® Series 751.
 - a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
 - b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
 - B. Pressure-Regulating Valves: UL 1468, brass or bronze, NPS 1-1/2 and NPS 2-1/2, 400-psig minimum rating. Include female NPS inlet and outlet, adjustable setting feature, and straight or 90-degree-angle pattern design as indicated.
 1. Finish: Rough chrome-plated.
 2. Manufacturers:
 - a. AFAC Inc.
 - b. Fire-End and Croker Corp.
 - c. Grinnell Fire Protection.
 - d. Potter-Roemer; Fire Protection Div.
 - e. Zurn Industries, Inc.; Wilkins Div.
 - C. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.
 1. Manufacturers:
 - a. AFAC Inc.
 - b. Grinnell Fire Protection.
- 2.13 MANUAL CONTROL STATIONS
- A. Manual Control Stations: UL listed or FMG approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- 2.14 CONTROL PANELS
- A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
 1. Panels: UL listed and FMG approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.

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2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and a cover held closed by breakable strut.
3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut.

2.15 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 250-psig minimum pressure rating if sprinklers are components of high-pressure piping system.
- B. Manufacturers:
 1. AFAC Inc.
 2. Globe Fire Sprinkler Corporation.
 3. Victaulic Co.
 4. Viking Corp.
 5. Tyco
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
 1. UL 199, for nonresidential applications.
 2. UL 1626, for residential applications.
 3. UL 1767, for early-suppression, fast-response applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
 1. Open Sprinklers: UL 199, without heat-responsive element.
 - a. Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
 - b. Orifice: 17/32 inch, with discharge coefficient K between 7.4 and 8.2.
- E. Sprinkler types, features, and options as follows:
 1. Concealed ceiling sprinklers, including cover plate.
 2. Extended-coverage sprinklers.
 3. Flush ceiling sprinklers, including escutcheon.
 4. High-pressure sprinklers.
 5. Institution sprinklers, made with a small, breakaway projection.
 6. Pendent sprinklers.
 7. Quick-response sprinklers.
 8. Recessed sprinklers, including escutcheon.
 9. Sidewall sprinklers.
 10. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Special Coatings: Nickel Teflon, wax, lead, and corrosion-resistant paint.

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- H. Sprinklers shall be glass-bulb type. Body shall be die-cast brass with hex-shaped wrench boss cast into the body to facilitate installation and reduce the risk of damage during installation.
- I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers. Provide and install 5" O.D. chrome plated expansion plates with all sprinklers in gypsum board and acoustical tile ceilings.
 - 1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 1-inch vertical adjustment.
 - 2. Sidewall Mounting: Chrome-plated steel Plastic, white finish, one piece, flat.
- J. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.
- K. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

2.16 HOSE CONNECTIONS

- A. Manufacturers:
 - 1. AFAC Inc.
 - 2. Central Sprinkler Corp.
 - 3. Fire-End and Croker Corp.
 - 4. Grinnell Fire Protection.
 - 5. Guardian Fire Equipment Incorporated.
 - 6. Potter-Roemer; Fire-Protection Div.
- B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle or gate pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 (DN 40 or DN 65) as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
 - 1. Valve Operation: Nonadjustable type, unless pressure-regulating type is indicated.
 - 2. Finish: Rough chrome-plated.

2.17 MONITORS

- A. Manufacturers:
 - 1. AFAC Inc.
 - 2. Fire-End and Croker Corp.
 - 3. Guardian Fire Equipment Incorporated.
 - 4. Potter-Roemer; Fire-Protection Div.
- B. Description: Stationary, single-waterway-type monitor for 750-gpm water stream. Include the following features:
 - 1. Waterway: NPS 2-1/2 minimum, brass or stainless-steel tube.
 - 2. Operation: Lever handle.

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3. Horizontal Rotation: 360 degrees with locking device.
4. Vertical Rotation: 80-degree elevation and 60-degree depression with locking device.
5. Nozzle: UL 401, NPS 2-1/2, brass, adjustable from fog spray to straight stream to shutoff.

2.18 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 1. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. Grinnell Fire Protection.
 - c. ITT McDonnell & Miller.
 - d. Potter Electric Signal Company.
 - e. Viking Corp.
 - f. Watts Industries, Inc.; Water Products Div.
- C. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
 1. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. Potter Electric Signal Company.
 - c. Viking Corp.
- D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 1. Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. Potter Electric Signal Company.
 - c. System Sensor.

2.19 PRESSURE GAUGES

- A. Manufacturers:
 1. AGF Manufacturing Co.
 2. AMETEK, Inc.; U.S. Gauge.

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3. Brecco Corporation.
 4. Dresser Equipment Group; Instrument Div.
 5. Marsh Bellofram.
 6. WIKA Instrument Corporation.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gauge with range of 0 to 300 psig.
1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
 2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14, and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PIPING APPLICATIONS, GENERAL

- A. Shop weld pipe joints where welded piping is indicated.
- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, Victaulic couplings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

3.4 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
 1. Sprinkler-Piping Fitting Option: Specialty sprinkler fittings, NPS 2-1/2 and smaller, including mechanical-T® and -cross fittings, may be used downstream from sprinkler zone valves.
 2. NPS 3/4" to 3": CPVC pipe and fittings

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3. NPS 1-1/2 and Smaller: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
4. NPS 1-1/2 and Smaller: Plain-end, black or galvanized, standard-weight steel pipe; locking-lug fittings; and twist-locked joints.
5. NPS 1-1/2 and Smaller: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
6. NPS 1-1/2 and Smaller: Threaded-end, black or galvanized, Schedule 30 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
7. NPS 1-1/2 and Smaller: Plain-end, black or galvanized, Schedule 30 steel pipe; locking-lug fittings; and twist-locked joints.
8. NPS 1-1/2 and Smaller: Plain-end, black, Schedule 30 steel pipe; steel welding fittings; and welded joints.
9. NPS 1-1/2 and Smaller: Threaded-end, threadable, thinwall steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
10. NPS 1-1/2 and Smaller: Plain-end, threadable, thinwall steel pipe; locking-lug fittings; and twist-locked joints.
11. NPS 1-1/2 and Smaller: Plain-end, threadable, thinwall steel pipe; steel welding fittings; and welded joints.
12. NPS 1-1/2 and Smaller: Plain-end, Schedule 10 steel pipe; locking-lug fittings; and twist-locked joints.
13. NPS 1-1/2 and Smaller: Plain-end, Schedule 10 steel pipe; steel welding fittings; and welded joints.
14. NPS 2: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
15. NPS 2: Plain-end, black or galvanized, standard-weight steel pipe; locking-lug fittings; and twist-locked joints.
16. NPS 2: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
17. NPS 2: Grooved-end, black or galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
18. NPS 2: Threaded-end, black or galvanized, Schedule 30 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
19. NPS 2: Plain-end, black or galvanized, Schedule 30 steel pipe; locking-lug fittings; and twist-locked joints.

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20. NPS 2: Plain-end, black, Schedule 30 steel pipe; steel welding fittings; and welded joints.
21. NPS 2: Grooved-end, black or galvanized, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
22. NPS 2: Threaded-end, threadable, thinwall steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
23. NPS 2: Plain-end, threadable, thinwall steel pipe; locking-lug fittings; and twist-locked joints.
24. NPS 2: Plain-end, threadable, thinwall steel pipe; steel welding fittings; and welded joints.
25. NPS 2: Grooved-end, threadable, thinwall steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
26. NPS 2: Plain-end, Schedule 10 steel pipe; locking-lug fittings; and twist-locked joints.
27. NPS 2: Plain-end, Schedule 10 steel pipe; steel welding fittings; and welded joints.
28. NPS 2: Grooved-end, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
29. NPS 2-1/2 to NPS 3-1/2: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
30. NPS 2-1/2 to NPS 3-1/2: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
31. NPS 2-1/2 to NPS 3-1/2: Grooved-end, black or galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
32. NPS 2-1/2 to NPS 3-1/2: Threaded-end, black or galvanized, Schedule 30 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
33. NPS 2-1/2 to NPS 3-1/2: Plain-end, black, Schedule 30 steel pipe; steel welding fittings; and welded joints.
34. NPS 2-1/2 to NPS 3-1/2: Grooved-end, black or galvanized, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
35. NPS 2-1/2 to NPS 3-1/2: Threaded-end, threadable, thinwall steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
36. NPS 2-1/2 to NPS 3-1/2: Plain-end, threadable, thinwall steel pipe; steel welding fittings; and welded joints.

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37. NPS 2-1/2 to NPS 3-1/2: Grooved-end, threadable, thinwall steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
38. NPS 2-1/2 to NPS 3-1/2: Plain-end, Schedule 10 steel pipe; steel welding fittings; and welded joints.
39. NPS 2-1/2 to NPS 3-1/2: Grooved-end, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
40. NPS 4 to NPS 6: CPVC Pipe and fitting..
41. NPS 4 to NPS 6: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
42. NPS 4 to NPS 6: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
43. NPS 4 to NPS 6: Grooved-end, black or galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
44. NPS 4 to NPS 6: Threaded-end, black or galvanized, Schedule 30 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
45. NPS 4 to NPS 6: Plain-end, black, Schedule 30 steel pipe; steel welding fittings; and welded joints.
46. NPS 4 to NPS 6: Grooved-end, black or galvanized, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
47. NPS 4 to NPS 6: Threaded-end, threadable, thinwall steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
48. NPS 4 to NPS 6: Plain-end, threadable, thinwall steel pipe; steel welding fittings; and welded joints.
49. NPS 4 to NPS 6: Grooved-end, threadable, thinwall steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
50. NPS 4 to NPS 6: Plain-end, Schedule 10 steel pipe; steel welding fittings; and welded joints.
51. NPS 4 to NPS 6: Grooved-end, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.5 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.

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- a. Shutoff Duty: Use ball, butterfly, or gate valves.
2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - b. Throttling Duty: Use ball or globe valves.

3.6 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gauge and comply with ASME B1.20.1.
- C. Twist-Locked Joints: Insert plain-end piping into locking-lug fitting and rotate retainer lug one-quarter turn.
- D. Pressure-Sealed Joints: Use UL-listed tool and procedure. Include use of specific equipment, pressure-sealing tool, and accessories. Pipe shall be square cut, +/- 0.030", properly deburred and cleaned. Pipe ends shall be marked at the required location, using a manufacturer-supplied gauge, to ensure full insertion into the coupling or fitting during assembly. Use a Victaulic "PFT" series tool with the proper sized jaw for pressing.
- E. Mechanically Formed, Copper-Tube-Outlet Joints: Use UL-listed tool and procedure. Drill pilot hole in copper tube, form branch for collar, dimple tube to form seating stop, and braze branch tube into formed-collar outlet.
- F. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
 2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 3. Copper Tube: Roll-groove tubing. Use copper tube dimensioned grooved-end fittings and grooved-end-tube couplings.
 4. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by Victaulic.
 5. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing.
 6. A Victaulic factory trained field representative shall provide on-site training to contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory trained representative shall periodically review

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the product installation. Contractor shall remove and replace any improperly installed products.

- G. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
 - 1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
 - 2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
 - 3. NPS 5 and Larger: Use dielectric flange insulation kits.

3.7 PIPING INSTALLATION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install drain valves on standpipes.
- J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- K. Install alarm devices in piping systems.
- L. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 - 1. Install standpipe system piping according to NFPA 14.
 - 2. Install sprinkler system piping according to NFPA 13.

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- M. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- N. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.
- O. Fill wet-standpipe system piping with water.
- P. Fill wet-pipe sprinkler system piping with water.
- Q. Install flexible connectors on fire-pump supply and discharge connections and in fire-suppression piping where indicated.
 - 1. Flexible type grooved joint mechanical couplings equal to Victaulic Style 75 or 77, may be used in lieu of flexible connectors for vibration isolation at equipment connections. Three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.

3.8 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Valves for Wall-Type Fire Hydrants: Install nonrising-stem gate valve in water-supply pipe.
- D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- E. Specialty Valves:
 - 1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.9 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: semi-recessed, recessed, flush, and concealed sprinklers, as indicated.

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3. Wall Mounting: Sidewall sprinklers.
4. Special Applications: Provide quick-response sprinklers in all areas.
5. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.10 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
- C. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protectors carefully by hand after installation. Do not use any tools to remove bulb protectors.
- D. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

3.11 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.
- B. Install freestanding hose connections for access and minimum passage restriction.
- C. Install NPS 1-1/2 hose-connection valves with flow-restricting device, unless otherwise indicated.
- D. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device, unless otherwise indicated.
- E. Install wall-mounting-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Refer to Division 10 Section "Fire-Protection Specialties" for cabinets.

3.12 MONITOR INSTALLATION

- A. Install monitor bases securely attached to building substrate.

3.13 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- D. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- E. Electrical Connections: Power wiring is specified in Division 26.
- F. Connect alarm devices to fire alarm.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding."
- H. Connect wiring according to Division 26 Section "Conductors and Cables."
- I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.14 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14 and in Division 23 Section "Mechanical Identification."

3.15 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Start and run air compressors.
 - 5. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 6. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - 7. Coordinate with fire alarm tests. Operate as required.
 - 8. Coordinate with fire-pump tests. Operate as required.

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9. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.16 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.17 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 1 Section "Closeout Procedures Demonstration and Training."

END OF SECTION

SECTION 22-0100
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This project is expected to be funded in whole or in part using funds from the American Recovery and Reinvestment Act (ARRA). Section 1605 of the ARRA prohibits the use of these funds unless all iron, steel, and manufactured goods are produced in the United States. All iron and steel manufacturing processes must take place in the United States, except for metallurgical processes involving refinement of steel additives. There is no requirement for the origin of components and subcomponents of manufactured goods. Products listed at 48 CFR 25.104(a) have been determined to be unavailable in the United States and if required for the project may be purchased from foreign sources. No unauthorized use of foreign iron, steel, and/or manufactured goods will be allowed on this project
- B. Provide all labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents.
- C. Principal features of work included are:
 - 1. Plumbing system including interface with outside utilities as shown on the plumbing drawings.
 - 2. Flashing of pipes where they penetrate outside walls.
 - 3. Seismic bracing and anchorage for piping.
 - 4. Demolition of existing piping.

1.2 RELATED WORK: The following work shall be furnished under other Divisions.

- A. The related electrical work is covered in Division 26, Electrical. Electrical power shall be provided and installed under the Electrical Division. Disconnects shall be furnished and installed under Electrical Division, unless noted otherwise in specific sections of that specification or as noted on Division 23 plans..
- B. Painting including piping shall be done under the Painting Division.
- C. Flashing of ducts and pipes into roofs shall be done under Architectural Division.
- D. Holes, chases and recesses required for mechanical work, where advance notice is given the Contractor.
- E. Miscellaneous steel work, such as equipment supports and framed openings for piping and duct.
- F. Access panels and door grilles shall be installed under other Divisions.
- G. Owner-furnished equipment shall be installed by other Divisions.

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- H. Openings in casework shall be provided by Casework Manufacturers.
- I. Provide necessary seismic hangers, vibration isolators, equipment mounts, etc. as required to accommodate all seismic protection requirements for all of the mechanical and plumbing work associated with this project per International Building Code requirements, along with any local codes or code amendments. Refer to structural documents for specific seismic parameter guidelines applicable to this project, and provide for accordingly. Provide shop drawings noting locations of all seismic devices, types of seismic required, and seismic device calculations signed and sealed by a qualified Professional Engineer, and to meet all local, and state code requirements related to seismic protection in effect on the date bids are received. Provide a certification from the manufacturer's Seismic Design Engineer that the final installed seismic devices will comply with all applicable code requirements. Equipment manufacturers shall provide certification that their equipment is capable of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic devices. Seismic protection devices shall be as manufactured by Amber/Booth Company, Inc.; Mason Industries, Inc.; or Kinetics Noise Control, Inc

PART 2 - PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT: Provide materials and equipment of domestic manufacture bearing the U.L. label when such label is available.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate locations of piping to eliminate conflict with other divisions.
- B. Carefully examine contract documents to be thoroughly familiar with items that require plumbing connections and coordination.
- C. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, changes in elevations, interferences, etc. Make necessary changes in the work, equipment locations, etc. as part of the contract to accommodate work to obstacles and interferences encountered. Before installing, verify exact location and elevation at work site.
- D. Coordinate work with other trades and determine route or location of each duct, pipe, conduit, etc., before fabrication and installation.
- E. Provide proper chases and openings. Place sleeves and supports prior to pouring concrete or installation of masonry.

3.2 CUTTING AND PATCHING

- A. Repair or replace routine damage caused by cutting.

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- B. Correct unnecessary damage caused due to installation of plumbing work.
 - C. Perform repairs with materials that match existing in accordance with the appropriate section of these specifications.
- 3.3 CONNECTION TO EQUIPMENT: Rough-in and connect to kitchen equipment and Owner furnished equipment and provide a shutoff valve and union at each connection. Operating valves and/or controls for this equipment will be provided as an integral part of the equipment.
- 3.4 TRENCHING, EXCAVATING, AND BACKFILLING
- A. Provide trenching, excavation, and backfilling necessary for performance of plumbing work.
 - B. Excavate to a depth at least 6" below bottom of pipe and a minimum of 36" above top of pipe. Fill below pipe, around pipe, and minimum of 12" above pipe with sand or Class "B" crushed stone tamped firm and even. Provide topsoil for final layer of dirt (12" minimum). Provide 6" spacing between pipes and between pipe and trench sides. Hand-grade with batterboards placed every 25'. Backfill by hand. Do not use rock or stone above sand or Class "B" crushed stone.
- 3.5 IDENTIFICATION
- A. Identify exposed or accessible piping with stenciling contents indicating pipe contents and direction of flow on piping not more than 30 feet apart, at valves, at access panels, and at least once above each space.
 - B. Waste, vent, sprinkler, rainwater, and buried lines need not be marked.
 - C. Identify each valve with engraved brass, aluminum, or stainless steel identification tag indicating valve service and sequential identification number. Attach tag to valve handle with brass, aluminum or stainless steel chain. Provide two bound manuals to Owner listing each valve sequentially and indicating valve manufacturer, style, size, service, normal position, and specific location for each valve.
 - D. No stenciling or labeling shall be performed until all painting required under architectural section has been performed.
- 3.6 PIPE CLEANING
- A. The system cleaning and testing described herein are minimum requirements. Additional tests as required by the authority having jurisdiction shall also be performed.
 - B. Piping and related items such as valves, etc., shall be inspected for sharp edges or other hazardous conditions. Such conditions shall be corrected by removal, modification or covering.
 - C. Factory applied prime coat paints shall be touched up to cover bare places and scratches. Weld joints shall be cleaned and painted with rust inhibitive paint, Galv-con, or approved equal, where galvanized pipe has been welded.

3.7 PIPE TESTING

- A. Testing shall be completed before insulation and concealment is started.
- B. All tests shall apply full test pressure to the piping for a minimum of twenty-four hours.
- C. All tests shall be conducted at the water working pressure of the pipe installed. When Schedule 40 or standard weight pipe is used, the test pressure shall be 150 pounds per square inch. When Schedule 80 or extra strong pipe is used, the test pressure shall be 250 pounds per square inch.
- D. When the test pressure has fallen over five percent during the twenty-four hour test period, the point of leakage shall be found, repaired and the test repeated. This procedure shall be followed until the piping system has been proven absolutely tight.
- E. The use of chemicals or so-called stop-leak compounds will not be permitted at any time.
- F. When delicate control mechanisms and other items having a rating less than the test pressure are installed in the piping system, they shall be removed during the tests to prevent shock damage. This does not apply to control valves.
- G. Leaks and other defects shall not be repaired by mastic or other temporary means. All leaks shall be repaired by removal of the valve, fitting joint, or section that is leaking and reinstalling new material with joints as specified hereinbefore.
- H. Piping may be tested a section at a time to facilitate construction. All gauges and instrumentation used shall have been recently calibrated in accordance with manufacturer's recommendations.

END OF SECTION

HANGERS & SUPPORTS FOR PLUMBING PIPING 22-0110-1
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SECTION 22-0110
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

- A. The work covered under this section consists of furnishing all necessary labor, supervision, materials, and equipment required to completely execute the pipe hanger and supports as described in this section.

1.2 REFERENCES

- A. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- B. ASTM A 123 – Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
- C. ASTM A 653 – Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.
- D. ASTM A 1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.
- E. MSS SP-58 – Manufacturers Standardization Society: Pipe Hangers and Supports – Materials, Design, and Manufacture.
- F. MSS SP-69 – Manufacturers Standardization Society: Pipe Hangers and Supports – Selection and Application

1.3 QUALITY ASSURANCE

- A. Steel pipe hangers and supports shall have the manufacturer's name, part number, and applicable size stamped in the part itself for identification.
- B. Hangers and supports shall be designed and manufactured in conformance with MSS SP-58.

1.4 SUBMITTALS

- A. Submit product data on all hanger and support devices, including shields and attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

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PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cooper B-Line, Inc., Anvil International, Inc., or approved equal.

2.2 PIPE HANGERS AND SUPPORTS

A. Hangers:

1. Un-insulated steel pipes ½" to 24" with NO LONGITUDINAL MOVEMENT:
 - a. Adjustable steel clevis hanger equal to B-Line B3100.
2. Un-insulated copper tubing and PVC pipe ½" O.D. to 4" O.D. with NO LONGITUDINAL MOVEMENT:
 - a. Plastic coated adjustable tubing ring hanger equal to B-Line B3170CTC.
3. Un-insulated cast iron soil pipe ¾" to 8":
 - a. Adjustable swivel, split ring type equal to B-Line B3171.
4. Un-insulated cast iron soil pipe 10" to 15":
 - a. Adjustable swivel, split ring type equal to B-Line B3100.
5. Insulated steel piping ½" to 24", galvanized steel piping ½" to 24", copper piping ½" O.D. to 4" O.D., and PVC pipe with NO LONGITUDINAL MOVEMENT:
 - a. Adjustable clevis hanger equal to B-Line B3100.
 - b. Galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation equal to B-Line B3151.

B. Pipe Clamps:

1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3142 with B3200 or approved equal. For insulated lines, use double bolted pipe clamps equal to B-Line B3144 or B3146 with B3200.

C. Multiple or trapeze hangers

1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS Gr. 33 structural steel channel, 1-5/8" x 1-5/8" minimum equal to B-Line B22 strut or stronger as required.
2. Mount pipes to trapeze with two piece pipe straps sized for outside diameter of pipe equal to B-Line B2000 series.
3. For pipes subject to axial movement:
 - a. Strut mounted roller support equal to B-Line B3126. Use pipe protection shield or saddles on insulated lines.
 - b. Strut mounted pipe guide equal to B-Line B2417.

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D. Wall Supports

1. Pipes 4" and smaller:
 - a. Carbon steel hook equal to B-Line B3191.
 - b. Carbon steel J-hanger equal to B-Line 3690.
2. Pipes larger than 4":
 - a. Welded strut bracket and pipe straps equal to B-Line B3064 and B2000 series.
 - b. Welded steel brackets equal to B-Line B3066 or B3067, with roller chair or adjustable steel yoke pipe roll equal to B-Line B3120 or B3110. Use pipe protection shield or saddles on insulated lines.

E. Floor Supports

1. Piping with NO LONGITUDINAL MOVEMENT and piping under 6" WITH LONGITUDINAL MOVEMENT:
 - a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation equal to B-Line B3093 and B3088T or B3090 and B3088. Pipe saddle shall be screwed or welded to appropriate base stand.

F. Vertical Supports

1. Steel riser clamp sized to fit outside diameter of pipe equal to B-Line B3373 or B3374.

2.3 UPPER ATTACHMENTS

A. Beam Clamps

1. Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.
2. C-Clamps shall have locknuts and cup point set screws equal to B-Line B351L or B3036L. Top flange C-clamps shall be used when attaching a hanger rod to the top flange of structural shapes and shall be equal to B-Line B3034 or B3033. Refer to manufacturers' recommendation for setscrew torque. Retaining straps shall be used to maintain the clamp's position on the beam where required. Retaining straps are REQUIRED for all seismically braced items.
3. Center loaded beam clamps shall be used where specified. Steel clamps shall be B-Line B3050 or B3055. Malleable iron or forged steel beam clamps with cross bolt shall be equal to B-Line B3054 or B3291 – B3297 series as required to fit beams.

B. Concrete Inserts

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1. Cast in place spot concrete inserts shall be used where applicable, either steel or malleable iron body equal to B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select insert nuts to suit threaded hanger and rod sizes equal to B-Line N2500 or B3014N series.
2. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A 1011 SS Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete inserts shall have a load rating of 2,000 lbs/ft in concrete and shall be equal to B-Line B221, B321, or B521 (B521 is limited to 1,500 lbs/ft). Select channel nuts suitable for strut and rod sizes.

2.4 ACCESSORIES

- A. Hanger rods shall be threaded on both ends and shall be equal to B-Line B3205. Continuous threaded rods of circular cross section may also be used. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.
- B. Shields shall be 180 degree galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match the outside diameter of the insulated pipe and shall be equal to B-Line B3151.
- C. Pipe protection saddles shall be formed from carbon steel, 1/8" minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12" shall have a center support rib.

2.5 FINISHES

- A. Hangers and strut located indoors and all hanger hardware shall be electro-plated zinc in accordance with ASTM B 633 SC1 or SC3.
- B. Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A 123. All hanger hardware shall be hot dip galvanized or stainless steel.
- C. Hangers and strut located in corrosive areas shall be Type 304 stainless steel with stainless steel hardware.

PART 3 - EXECUTION

3.1 PIPE HANGERS AND SUPPORT

- A. Pipe shall be adequately supported by pipe hanger and supports specified in Part 2 - Products. Hangers for insulated pipes shall be sized to accommodate insulation thickness.

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- B. Horizontal steel piping shall be supported in accordance with MSS SP-69, Tables 3 and 4. The following is an excerpt from those tables:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
3/8" – 1-3/4"	3/8"	7'-0"
1-1/2"	3/8"	9'-0"
2"	3/8"	10'-0"
2-1/2"	1/2"	11'-0"
3"	1/2"	12'-0"
3-1/2"	1/2"	13'-0"
4"	5/8"	14'-0"
5"	5/8"	16'-0"
6"	3/4"	17'-0"
8"	3/4"	19'-0"
10"	7/8"	22'-0"
12"	7/8"	23'-0"
14"	1"	25'-0"
16"	1"	27'-0"

- C. Horizontal copper tubing shall be supported in accordance with MSS SP-69, Tables 3 and 4. The following is an excerpt from those tables:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
1/4" – 3/4"	3/8"	5'-0"
1"	3/8"	6'-0"
1-1/4"	3/8"	7'-0"
1-1/2"	3/8"	8'-0"
2"	3/8"	8'-0"
2-1/2"	1/2"	9'-0"
3"	1/2"	10'-0"
3-1/2"	1/2"	11'-0"
4"	1/2"	12'-0"
5"	1/2"	13'-0"
6"	5/8"	14'-0"
8"	3/4"	16'-0"

- D. Horizontal Schedule 40 PVC piping shall be supported in accordance with the following table:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
1/2"	3/8"	4'-0"
3/4"	3/8"	4'-0"

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1"	3/8"	4'-6"
1-1/4" – 2"	3/8"	5'-0"
2-1/2" – 3"	1/2"	6'-0"
4"	1/2"	6'-6"
6"	5/8"	7'-6"
8"	3/4"	8'-0"
10"	3/4"	8'-6"
12"	3/4"	9'-6"

- E. Horizontal Schedule 80 PVC piping shall be supported in accordance with the following table:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
1/2"	3/8"	4'-6"
3/4"	3/8"	4'-6"
1"	3/8"	5'-0"
1-1/4" – 1-1/2"	3/8"	5'-6"
2"	1/2"	6'-0"
2-1/2"	1/2"	6'-6"
3"	1/2"	7'-0"
4"	1/2"	7'-6"
6"	5/8"	9'-0"
8"	3/4"	9'-6"
10"	3/4"	10'-0"
12"	3/4"	10'-6"

3.2 CONCRETE INSERTS

- A. Provide inserts for placement in formwork before concrete is poured.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Where concrete slabs from finished ceilings, provide inserts to be flush with slab surface.
- D. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

3.3 GENERAL

- A. Pipe shall be suspended from the building structure in a neat and workmanlike manner. Wherever possible, parallel runs of horizontal pipe shall be grouped on trapeze type hangers utilizing angle iron or uni-strut. Excess all thread rod shall not exceed 1 1/2 "below pipe support.

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- B. The use of wire or perforated metal strapping is not permitted.
- C. Hanging of pipe from other pipes, duct, etc is not permitted.
- D. Supports shall be designed and installed such that neither pipe nor supports will be subject to electrolytic action. Provide dielectric isolation between dissimilar metals of piping and supports (tape (electricians, duct, etc. is not acceptable).
- E. Provide anchors as required for proper anchorage including channels, plate etc.
- F. Insulation saddles shall be adhered to the insulation jacket with adhesive.
- G. Hangers for piping 2 ½” and smaller utilizing teardrop hangers, hanger and pipe shall be insulated as an assembly. Piping 3” and above shall be supported by sections of cellular glass (foam glass) insulation placed in the insulation saddle to protect against damage to the insulation caused by excessive weight. Installation of just a metal pipe saddle is not sufficient.
- H. Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents. Cast-iron soil pipe shall be supported at not less than every story height and at its base. Screwed pipe shall be supported at not less than every other story height. Copper tubing shall be supported at each story for piping ¾ inch and over and at not more than intervals of four feet for 5/8 inch and smaller.
- I. Cast iron soil pipe shall be supported at not more than intervals of five feet and at least once in each joint of pipe, unless stainless steel couplings, manufactured by Clamp-all Corporation or equal, are utilized. If stainless steel couplings are use, piping supports shall be provided at not more than five (5) foot intervals except for pipe runs exceeding five (5) feet in length, which shall be supported at not more than ten (10) foot intervals.
- J. No-hub piping shall have, especially in the smaller sizes, additional hangers. Hang no-hub piping with sufficient hangers so that piping is rigidly supported.
- K. Piping may be grouped together and supported from galvanized angle iron trapeze hangers. Provide insulation saddles to protect the pipe insulation.

END OF SECTION

SECTION 22-0523
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 ACCEPTABLE MANUFACTURERS

A. Valves shall be Nibco, Crane, Apollo or approved equal.

1.2 REQUIREMENTS

A. Provide clamp lock hand lever operators on valves less than 6 inches. Provide hand wheel and closed housing worm gear on valves 6 inches and larger unless indicated otherwise below. Provide chain operators for all equipment room and powerhouse valves 4 inch and larger which are located over 6 feet 6 inches above the finish floor. All valves shall be of the extended neck design to allow for the installation of full thickness insulation over flanges. Provide rubber end caps on all exposed valve stems under 7'-0" to prevent bump hazards. Valves shall be installed upright with no more than 45 degrees off center.

PART 2 - PRODUCTS

2.1 GATE VALVES

A. Provide gate valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2" & smaller	T113 (threaded) / S113 (soldered)	125
Hot & Cold Domestic Water	2-1/2" & larger	F617-0	125

2.2 BALL VALVES

A. Provide ball valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2-1/2" & smaller	T585-70 (threaded) / S585-70 (soldered)	150# CWP

B. Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. A protective sleeve shall be provided that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Include fully adjustable memory stops for all ball valves.

2.3 BUTTERFLY VALVES

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A. Provide butterfly valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2-1/2" to 6"	LD2000-3	200
Hot & Cold Domestic Water	8" & larger	LD2000-5	200

B. Valves 8" and larger shall have weatherproofed sealed gear operator consisting of fully enclosed worm, worm gear, and worm shaft with hand wheel to provide necessary torque for close-off and infinite throttling positions. Valves 6" and smaller to have 10 position lever lock handle suitable for on-off and manual throttling service. All operators to have valve position indicator and memory stop.

2.4 GLOBE VALVES

A. Provide globe valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2" & smaller	T-211-Y (threaded) / S-211-Y (solder)	125
Hot & Cold Domestic Water	2-1/2" & larger	F718-B	125

2.5 CHECK VALVES

A. Provide check valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	2" & smaller	T-413-Y (threaded) / S-413-Y (solder)	125
Hot & Cold Domestic Water	2-1/2" & larger	F-918-B	125

2.6 FLOW BALANCING VALVES

A. Provide flow balancing valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Hot & Cold Domestic Water	1/2" to 2"	T-1710 (threaded) / S-1710 (solder)	240

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- B. Provide valve with memory stop, capped differential pressure readout ports with internal check valves and performed insulation.

2.7 PLUG VALVES

- A. Plug valves shall be lubricated cylindrical plug valves constructed of ASTM A-126, grade B semi-steel and rated for 150 psig working pressure. Square head shall move from fully opened to fully closed with quarter turn of plug. Plug shall float in lubricant. Teflon head seat gasket shall be backed by lubricant reservoir. Valves 2" and smaller shall have screwed ends, 2-1/2" and larger to be flanged. Provide one wrench per valve size and mount on rack in equipment room. Homestead #611 for valves 2" and smaller, Homestead #612 for valves 2-1/2" through 6", Homestead #612-GW for valves 8" and larger. Valves to be factory pre-lubricated with Homestead #204. Provide two high pressure lubricant guns with 17-1/2" long extension hose equivalent to Homestead Type "B" and two cartons of Homestead #204 gun stick lubricant suited for clean water service between minus 30 degrees F and 400 degrees F. Wall mount lubricant guns on a red colored painted wood panel and locate panel in main equipment room near pumps.

2.8 GAS SHUTOFF VALVES

- A. Shutoff valves shall be provided at each piece of equipment and shall be Class 125 gas line cocks with cast iron body, bronze plug and washer, and iron nut, Crane Figure 324.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The installation of butterfly valves in water piping systems shall allow for ordinary maintenance work to be performed on the equipment these butterfly valves isolate, without having to drain the system beyond the butterfly valve. For instance, a check valve, of the type which would have to be removed from the line to replace the clapper or liner, should not be bolted onto a water type butterfly valve since removal of the check valve from the line would involve removing the butterfly valve also.
- B. Valves shall be located so as to be accessible by maintenance personnel. Valves 2 1/2 and larger shall have piping supported on each side of the valve.
- C. Valves shall be installed with stem no longer than horizontal position. Prior to installation valves shall be thoroughly cleaned to remove foreign material.

END OF SECTION

SECTION 22-0700
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of piping insulation work as indicated on the drawings and by the requirements of this section.

1.2 QUALITY ASSURANCE

- A. Provide piping and duct insulation products produced by one or more of the following manufacturers for each type of insulation and temperature range required:
1. Armacell LLC.
 2. CertainTeed Corp.
 3. Johns Manville
 4. Knauf Fiberglass
 5. Owens Corning
 6. Pittsburg Corning Corp.
- B. Fire/Smoke Ratings: Provide composite pipe insulation (insulation, jackets, covering, sealers, mastics and adhesives) with flame-spread rating and smoke-developed rating as tested by ASTM E84 (NFPA 225) method. Composite rating shall not exceed the values shown with the physical properties for each type of insulation in this section.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

- A. Flexible Tubular Elastomeric:
1. Provide fire-retardant closed-cell slip-on flexible type. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 220 degrees F and a minimum "R" value of 3.70. Product to be equivalent to Armacell LLC "Armaflex AP". Applicable products manufactured by Manville and Rubatex are acceptable. Provide insulation for the following services:
 - (a) Moisture condensate drains - 1/2" thick.
- B. Fiberglass:
1. Provide factory-formed factory-jacketed "system" type conforming strictly to fire-resistive qualities herein before specified in "Quality Assurance"

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section. Jacket to be vapor-barrier type when used for systems operating below 60 degrees F. "System" density shall not less than 4 pounds per cubic foot. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 650 degrees F and a minimum "R" value of 4.00. Product to be equivalent to Manville "Micro-Lok 650" with type AP jacketing. Product to be manufactured by Owens Corning, Manville or Knauf. Jacket to be fiberglass reinforced kraft paper with aluminum foil and self-sealing lap joint.

2. Provide insulation of thickness for following services:
 - (a) Domestic cold water piping: 1/2" thick for 2" and smaller pipe, 1" thick for 2-1/2" and larger pipe.
 - (b) Domestic hot water piping (for non re-circulating systems only): 1/2" thick for 2" and smaller pipe, 1" thick for 2-1/2" and larger pipe.
 - (c) Domestic automatic re-circulating hot water systems: 1" thick for hot water and recirculation piping.
 - (d) Horizontal rainwater leaders and roof drain bodies: 1" thick.
- C. Insulation may be deleted on 3/4" and smaller domestic water piping located inside interior walls.
- D. Piping located in unconditioned mechanical rooms, attics, or exposed to the weather shall have the thickness listed above increased by 1/2".
- E. For any service when above grade exposed-to-the-weather outside building, cover straight pipe insulation with 0.016" thick aluminum jacket equivalent to Childers and cover valves and fittings with .024" thick aluminum factory formed covers equivalent to Childers Ell-Jacs.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Pipe saddles for protection of the insulation shall be provided by the insulation sub-contractor and installed at the time the insulation is applied. Saddles shall be secured to insulation with adhesive.
- B. Insulate all surfaces as indicated by drawings and specifications. Where more than one type of insulation is indicated for a particular application, selection shall be the contractors option.
- C. Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices.

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- D. Surfaces shall be clean and dry prior to application of insulation. The piping system shall be tight with all testing and corrections complete.
- E. Install insulation materials with smooth and even surfaces. Insulate each continuous run of pipe with full-length units of insulation, with a single cut piece to complete each run. Do not use cut pieces or scraps abutting each other.
- F. Cover valves, flanges, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, pre-cut, or job fabricated units (at installers option), except where a specific form or type is indicated. In no case shall insulation cover gauges, plug cock indicators, or other items required for visual reference.
- G. Extend insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation. Insulation shall not be installed over pipe hangers.
- I. All pipe insulation exposed to weather, except as otherwise described, shall be finished with .016 inch, (standard thickness) aluminum jacket and pre-formed aluminum fitting covers, by Childers or approved equal.
- J. Fiberglass Insulation on Cold Piping:
 - 1. Insulation on concealed piping shall be finished with white paintable, fire-retardant ASJ jacket.
 - 2. Butt all joints firmly together and smoothly secure all jacket laps and joint strips with lap adhesive. End of pipe insulation shall be sealed off with a vapor barrier coating at all fittings and valves and at each joint of insulation in addition to any other manufacture's recommendations.
 - 3. Insulate fittings and valves with molded fiberglass fittings, segments of pipe insulation, or with firmly compressed foil-faced fiberglass blanket with PVC covers. Secure in place with 20 gauge corrosion-resistant wire and apply a smoothing coat of insulating cement. Vapor seal by applying a layer of open-weave glass cloth fabric embedded between two coats of vapor-barrier mastic. Lap glass fabric 2" onto adjacent pipe. (In lieu of glass cloth embedded between coats of mastic, premolded fitting covers sealed at all edges with vapor barrier adhesive. Secure ends of covers with pressure-sensitive vinyl tape).
- K. Fiberglass Insulation on Hot Piping:
 - 1. Insulation on concealed piping shall be finished with white paintable, fire-retardant ASJ jacket.
 - 2. Butt all joints firmly together and smoothly secure all jacket laps and joint strips with lap adhesive. Flare type staples at 4 inch spacing may be used

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for concealed work.

3. Insulate fittings and valves with molded fiberglass fittings, segments of pipe insulation, or with firmly compressed fiberglass blanket with PVC covers. Secure in place with 20 gauge wire and finish with a coat of insulating cement. Fittings for pipe sizes under 4" may be insulated with hydraulic setting insulating cement. All thickness' to be equal to that of adjoining pipe covering. Exposed fittings and valves shall be additionally finished with open-weave glass cloth fabric adhered between two floor coats of lagging adhesive. Lap glass fabric 2" onto adjacent pipe. (In lieu of glass cloth embedded between coats of adhesive premolded fitting covers may be used. The covers shall overlap the adjoining pipe insulation and shall be mechanically secured).

END OF SECTION

SECTION 22-1100
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes domestic water piping and water meters inside the building.
- B. Water meters will be furnished and installed by utility company.
- C. Related Sections include the following:
 - 1. Division 2 Section "Water Distribution" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.
 - 2. Division 22 Section "Meters and Gauges" for thermometers, pressure gauges, and fittings.
 - 3. Division 22 Section "Plumbing Specialties" for water distribution piping specialties.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings and water meters.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body, with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
 - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
 - 6. Steel-Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
 - 7. Steel-Piping, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

2.4 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

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1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
 - a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
- C. Provide copper press fitting with EPDM O-rings. Use press fittings where indicated on plans and install per manufacturer's recommendations. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). In ProPress ½" to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. This provides the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
- 2.5 PEX PIPING -
- A. Use crosslinked polyethylene pipe tubing and ASTM F1960 cold expansion fittings.
1. Standard grade hydrostatic pressure ratings from Plastics Pipe Institute (PPI) in accordance with TR-3 as listed in TR-4. The following three standard-grade hydrostatic ratings are required.
 - a. 200°F (93°C) at 80 psi (551 kPa)
 - b. 180°F (82°C) at 100 psi (689 kPa)

- c. 73.4°F (23°C) at 160 psi (1,102 kPa)
- 2. Certification of flame spread/smoke development rating of 25/50 in accordance with ASTM E84 provided the installation meets one of the following requirements.
 - a. Tubing spacing is a minimum of 18 inches apart for the following sizes.
 - 1) $\frac{3}{8}$ inch [9.53mm]
 - 2) $\frac{1}{2}$ inch [12.7mm]
 - 3) $\frac{5}{8}$ inch [15.88mm]
 - 4) $\frac{3}{4}$ inch [19.05mm]
 - b. Tubing is wrapped with $\frac{1}{2}$ " fiberglass insulation with a flame spread of not more than 20 and a smoke-developed rating of not more than 30 and a nominal density of 4.0 to 4.5 pcf. Tubing can run with three tubes separated by zero inches and then 18 inches between the next group of three tubes for the following sizes.
 - 1) $\frac{3}{8}$ inch [9.53mm]
 - 2) $\frac{1}{2}$ inch [12.7mm]
 - 3) $\frac{5}{8}$ inch [15.88mm]
 - 4) $\frac{3}{4}$ inch [19.05mm]
 - 5) 1 inch [25.4mm]
 - 6) $1\frac{1}{4}$ inch [31.75mm]
 - 7) $1\frac{1}{2}$ inch [38.1mm]
 - 8) 2 inch [50.8mm]

2.6 VALVES

- A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section "Valves."
- B. Balancing and drain valves are specified in Division 22 Section "Plumbing Specialties."

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
 - B. Flanges may be used on aboveground piping, unless otherwise indicated.
 - C. Grooved joints may be used on aboveground grooved-end piping.
 - D. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 2 Section "Water Distribution."
- A. Domestic Water Piping on Service Side of Water Meter inside the Building: Use any of the following piping materials for each size range:
- 1. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 2. NPS 1-1/4 and NPS 4: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 3. NPS 4 to NPS 6: Steel pipe; gray-iron, threaded fittings; and threaded joints.
 - 4. NPS 4 to NPS 6: Steel pipe with grooved ends; steel-piping, grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
 - 5. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 6. NPS 8: Steel pipe; gray-iron, threaded fittings; and threaded joints.
 - 7. NPS 10 and NPS 12: Steel pipe; gray-iron, threaded fittings; and threaded joints.
- B. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 and Smaller: Soft copper tube, Type K; copper pressure fittings; and soldered joints.
- C. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
- 1. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints. ProPress Fittings or PEX Piping can be used at contractors option.
 - 1. NPS 1-1/4 and NPS 4: Hard copper tube, Type L; copper pressure fittings; and soldered joints. ProPress Fittings or PEX Piping can be used at contractors option.
- D. Press connections: Copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting

and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball for piping NPS 2 and smaller. Use cast-iron butterfly with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Cast-iron, grooved-end valves may be used with grooved-end piping.
- C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Plumbing Specialties."

3.4 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."

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- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve, inside the building at each domestic water service entrance. Pressure gauges are specified in Division 22 Section "Meters and Gauges," and drain valves and strainers are specified in Division 22 Section "Plumbing Specialties."
- F. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 22 Section "Plumbing Specialties."
- G. Install domestic water piping level without pitch and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.6 WATER METER INSTALLATION

- A. Rough-in domestic water piping for water meter installation according to utility company's requirements.
- B. Water meters will be furnished and installed by utility company.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration and Seismic Controls."
- B. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

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- c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
- 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
 - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- G. Install supports for vertical steel piping every 22 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
- 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.

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- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
 - 1. Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
 - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 125 psig. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

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1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 -1119
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following plumbing specialties:

1. Backflow Preventers.
2. Dishwasher air-gap fittings.
3. Water regulators.
4. Balancing valves.
5. Water filters.
6. Thermostatic water mixing valves.
7. Water tempering valves.
8. Strainers.
9. Drain valves.
10. Miscellaneous piping specialties.
11. Sleeve penetration systems.

- B. Related Sections include the following:

1. Division 22 Section "Meters and Gauges" for water meters, thermometers, and pressure gauges.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PE: Polyethylene plastic.
3. PUR: Polyurethane plastic.

4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 1. Domestic Water Piping: 125 psig.

1.5 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
 1. Backflow Preventers and water regulators.
 2. Balancing valves, water filters, and strainers.
 3. Thermostatic water mixing valves and water tempering valves.
 4. Drain valves.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field test reports.
- D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
 1. Backflow Preventers and water regulators.
 2. Water filters.
 3. Thermostatic water mixing valves and water tempering valves.

1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Water Filter Cartridges: Equal to 200 percent of amount installed for each type and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 BACKFLOW PREVENTERS

A. Available Manufacturers:

1. Manufacturers:
 - a. Ames Co., Inc.
 - b. Cla-Val Co.
 - c. CMB Industries, Inc.; Febco Backflow Preventers.
 - d. Conbraco Industries, Inc.
 - e. Mueller Co.; Hersey Meters Div.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE standard, backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.

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2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 - a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
 3. Interior Components: Corrosion-resistant materials.
 4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
 5. Strainer: On inlet, if indicated.
- C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.
- D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.
- E. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.
 1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
- F. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.
 1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
- G. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.
 1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
- H. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves.
- I. Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, NPS 3/8.
- J. Laboratory Faucet Vacuum Breakers: ASSE 1035, suitable for continuous pressure application and chrome plated; consisting of primary and secondary checks; intermediate vacuum breaker; and threaded ends, NPS 1/4 or NPS 3/8 as required.

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- K. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.
 - 1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
- L. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.
 - 1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
- M. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.3 BALANCING VALVES

- A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Available Manufacturers:
 - 1. Manufacturers:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Flow Design, Inc.
 - d. ITT Industries; Bell & Gossett Div.
 - e. Taco, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - 2. Retain one of first two subparagraphs below.
 - 3. NPS 2 and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
 - 4. NPS 2-1/2 and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

2.4 WATER FILTERS

- A. Available Manufacturers:

1. Manufacturers:
 - a. Filtrine Manufacturing Company; Drinking Water Division.
 - b. Manitowoc Ice, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Culligan
 - B. General: Cartridge-type assemblies suitable for potable water. Include housing, fittings, filter cartridges, and cartridge end caps.
 - C. Wall-Mounting Type: Housing head section with threaded inlet and outlet, mounting bracket, and removable lower section for 10-inch- long filter cartridge.
 1. Housing Material: Stainless steel, 150-psig minimum operating pressure.
 2. Cartridge: Activated-charcoal filter media, 10 inches, 10-micron-particulate removable rating.
 - D. Floor-Mounting Type: Stainless-steel housing rated at 150-psig minimum operating pressure.
 1. Base Section: Floor-mounting section with inlet and outlet connections and removable top section for one or more 10-micron-particulate, removable-rating cartridges.
 2. Connections, NPS 2 and Smaller: Threaded.
 3. Connections, NPS 2-1/2 and Larger: Flanged.
 4. Cartridges: Activated-charcoal filter media.
- 2.5 THERMOSTATIC WATER MIXING VALVES
- A. Available Manufacturers:
 1. Manufacturers:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Mark Controls Corp.; Powers Process Controls.
 - d. Symmons Industries, Inc.
 - e. T & S Brass and Bronze Works, Inc.
 - B. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer.
 1. Type: Liquid-filled motor, operation and pressure rating 100 psig minimum.

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- C. Thermostatic Water Mixing Valves: Unit, with the following:
1. Piping, valves, and unions. Include thermometer if not in cabinet.
 2. Piping Component Finish: Rough bronze.
 3. Cabinet: Surface-mounting steel box with steel hinged door, white enameled finish, and thermometer in front.
 4. Cabinet: Surface-mounting stainless-steel box with stainless-steel hinged door and thermometer in front.
- D. Manifolder, Thermostatic Water Mixing-Valve Assemblies: Factory-fabricated unit consisting of parallel arrangement of thermostatic water mixing valves.
1. Arrangement: One large-flow, thermostatic water mixing valve with flow-control valve, pressure regulator, inlet and outlet pressure gauges, and one small-flow, thermostatic water mixing valve with flow-control valve. Include outlet thermometer, factory- or field-installed inlet and outlet valves, and other indicated options.
 2. Include piping, valves, and unions.
 3. Piping Component Finish: Rough bronze.
 4. Cabinet: Surface-mounting steel box with steel hinged door, white enameled finish, and thermometer in front.
 5. Cabinet: Surface-mounting stainless-steel box with stainless-steel hinged door and thermometer in front.

2.6 STRAINERS

- A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.
1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
 2. NPS 2 and Smaller: Bronze body, with female threaded ends.
 3. NPS 2-1/2 and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
 4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
 - a. Drain: Factory- or field-installed, hose-end drain valve.

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- B. Drainage Basket Strainers: Non-pressure-rated, cast-iron or coated-steel body; with bolted flange or clamp cover and drain with plug.
 - 1. Basket: Bronze or stainless steel with 1/8- or 3/16-inch- diameter holes and lift-out handle.
 - 2. Female threaded ends for NPS 2 and smaller, and flanged ends for NPS 2-1/2 and larger.

2.7 DRAIN VALVES

- A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.
 - 1. Inlet: Threaded or solder joint.
 - 2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.
- B. Hose-End Drain Valve: MSS SP-80, gate valve, Class 125, ASTM B 62 bronze body, with NPS 3/4 threaded or solder-joint inlet and ASME B1.20.7, garden-hose threads on outlet and cap. Hose bibbs are prohibited for this application.
- C. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 side drain outlet and cap.

2.8 MISCELLANEOUS PIPING SPECIALTIES

- A. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.9 SLEEVE PENETRATION SYSTEMS

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. ProSet Systems, Inc.
- C. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
 - 1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - 2. Stack Fitting: ASTM A 48, gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

- a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gauges on inlet and outlet.
- C. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.
- D. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- E. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- F. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- G. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- H. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- I. Install air vents at piping high points. Include ball, gate, or globe valve in inlet and drain piping from outlet to floor drain.
- J. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 22 Sections.
- D. Ground equipment.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer, thermostatic water mixing valve, water tempering valve.
 - 1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
 - 2. Refer to Division 22 Section "Mechanical Identification" for nameplates and signs.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled grease recovery units and their installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment. Refer to Division 1 Section "Closeout Procedures Demonstration and Training."

END OF SECTION

SECTION 22-1316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.
 - 4. **Construction Manager shall be responsible for underground piping with sanitary tees for connection by component contractor as shown on drawings**
 - 5. **Component contractor is responsible for all piping above ground and connections to underground piping.**

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water].

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- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to [ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
 - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
- C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: CISPI 310 and ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard Shielded, Type 301 Stainless-Steel Couplings: With Type 301 AISI stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564 rubber gasket.

2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- B. Drainage Fittings: ASME B16.12, threaded, cast-iron drainage pattern.

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C. Pressure Fittings:

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125 standard pattern.
4. Cast-Iron Flanges: ASME B16.1, Class 125.
5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125.

2.4 STAINLESS-STEEL PIPE AND FITTINGS

- A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.
- B. Gaskets: Lip seals shaped to fit socket groove, with plastic backup ring.
 1. Material: EPDM, unless NBR is indicated.

2.5 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.
- C. Flanges: ASME 16.1, Class 125, cast iron.

2.6 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

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- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- C. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.7 ABS PIPE AND FITTINGS

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

2.8 PVC PIPE AND FITTINGS

- A. Solid-Wall Schedule 40 PVC Pipe: ASTM D 2665, drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.9 POLYPROPYLENE PIPE

- A. Schedule 40 single wall polypropylene pipe ASTM D4101 with fusion fittings.
 - 1. Underground – Orion Brownline, with fusion joints
 - 2. Aboveground – Orion Blueline fire retardant

2.10 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

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- c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 - D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - 1. Center-Sleeve Material: Manufacturer's standard].
 - 2. Gasket Material: Natural or synthetic rubber.
 - 3. Metal Component Finish: Corrosion-resistant coating or material.
 - E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
 - F. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - G. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - H. Tubular Fittings: ASTM F 409, ABS and PVC drainage-pattern tube and tubular fittings with ends as required for application.
- 2.11 ENCASEMENT FOR UNDERGROUND METAL PIPING
- A. Description: ASTM A 674 or AWWA C105, high-density, cross laminated PE film of 0.004-inch] or LLDPE film of 0.008-inch minimum thickness.
 - B. Form: Sheet or tube.
 - C. Color: Black or natural.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Steel pipe, drainage fittings, and threaded joints.
 - 3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
 - 4. Copper DWV tube, copper drainage fittings, and soldered joints
 - 5. Solid Wall PVC.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, and heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Solid Wall PVC.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Steel pipe, drainage fittings, and threaded joints.
 - 3. Stainless-steel pipe and fittings gaskets, and gasketed joints.
 - 4. Copper DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
 - 5. Solid Wall PVC.

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- E. Aboveground, vent piping NPS 5 and larger shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Steel pipe, drainage fittings, and threaded joints.
 - 3. Solid Wall PVC.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
- G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
- H. Underground, acid resistant waste piping shall be the following:
 - 1. Polypropylene – Orion Brownline
- I. Aboveground, acid resistant waste piping shall be the following:
 - 1. Polypropylene – Orion Blueline

3.3 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."
- B. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration and Seismic Controls."
- D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- F. Install underground, ductile-iron, special pipe fittings according to AWWA C600.
 - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.

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- G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- H. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- I. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 1/2 and smaller; 1 percent downward in direction of flow for piping NPS 3 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- N. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

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- O. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration Controls and Seismic Restraints."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

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- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

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- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

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4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 22-1413
STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following storm drainage piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.
 - 4. **Construction Manager shall be responsible for underground piping with sanitary tees for connection by component contractor as shown on drawings**
 - 5. **Component contractor is responsible for all piping above ground and connections to underground piping.**

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic.
- E. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.
 - 2. Storm Drainage, Force-Main Piping: 150 psig.

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- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
 - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
 - 2. Controlled-Flow Storm Drainage System: Include calculations, plans, and details.
- C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Lead and Oakum: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: CISPI 310 and ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard Shielded, Type 301 Stainless-Steel Couplings: With Type 301 AISI stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564 rubber gasket.
- C. Rigid, Unshielded Couplings: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. ANACO.

2.5 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- B. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
- C. Pressure Fittings:
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- D. Grooved-Joint Systems:
 - 1. Manufacturers:
 - a. Anvil International.
 - b. Star Pipe Products; Star Fittings Div.

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- c. Victaulic Co. of America.
 - d. Ward Manufacturing, Inc.
- 2. Grooved-End, Steel-Piping Fittings: ASTM A 47/A 47M, galvanized, malleable-iron casting; ASTM A 106, galvanized-steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.
 - 3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.6 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Gaskets: AWWA C111, rubber.
- C. Grooved-Joint Systems:
 - 1. Manufacturers:
 - a. Victaulic Co. of America.
 - b. Insert manufacturer's name.
 - 2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - 3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- D. Flanges: ASME 16.1, Class 125, cast iron.

2.7 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

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1. Copper Drainage Fittings: ASME B16.23, cast-copper or ASME B16.29, wrought-copper, solder-joint fittings.
 - B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - C. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
- 2.8 PVC PIPE AND FITTINGS
- A. Solid-Wall Schedule 40 PVC Pipe: ASTM D 2665, drain, waste, and vent.
- 2.9 SPECIAL PIPE FITTINGS
- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 1. Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco, Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Co.
 - e. NDS, Inc.
 - f. Plastic Oddities, Inc.
 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 1. Manufacturers:

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- a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.
- C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
 - a. ANACO.
- D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. EBAA Iron Sales, Inc.
 - d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - e. JCM Industries, Inc.
 - f. Romac Industries, Inc.
 - g. Smith-Blair, Inc.
 - h. Viking Johnson.
 2. Center-Sleeve Material: Manufacturer's standard.
 3. Gasket Material: Natural or synthetic rubber.
 4. Metal Component Finish: Corrosion-resistant coating or material.
- E. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
1. Manufacturers:
 - a. EBAA Iron Sales, Inc.
 - b. Romac Industries, Inc.
 - c. Star Pipe Products; Star Fittings Div.
- F. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
1. Manufacturers:

a. SIGMA Corp.

2.10 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 2 to NPS 6 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Copper DWV tube, copper drainage fittings, and soldered joints.
- C. Aboveground, storm drainage piping NPS 8 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
- D. Underground storm drainage piping NPS 3 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Solid-wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground, storm drainage piping NPS 8 and larger shall be any of the following:

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1. Service class, cast-iron soil piping and fittings; gaskets; and gasketed joints.
 2. Solid-wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Aboveground storm drainage force mains NPS 2 and larger shall be any of the following:
1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 2. Steel pipe, pressure fittings, and threaded joints.
- G. Aboveground storm drainage force mains NPS 6 and larger shall be any of the following:
1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 2. Steel pipe, pressure fittings, and threaded joints.
 3. Grooved-end steel pipe, grooved-joint system fittings and couplings, and grooved joints.
- H. Underground storm drainage force mains NPS 4 and smaller shall be any of the following:
1. Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
 2. Steel pipe, pressure fittings, and threaded joints.
 - a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
 3. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron fittings; glands, gaskets, and bolts; and mechanical joints.
 - a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
 4. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron fittings; gaskets; and gasketed joints.
 - a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
- I. Underground storm drainage force mains NPS 5 and larger shall be any of the following:
1. Steel pipe, pressure fittings, and threaded joints.
 2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron fittings; glands, gaskets, and bolts; and mechanical-joint joints.

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3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron fittings; gaskets; and gasketed joints.

3.3 PIPING INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 2 Section "Storm Drainage."
- B. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration and Seismic Controls."
- D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Plumbing Specialties."
- E. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- F. Install underground, steel, force-main piping. Install encasement on piping according to ASTM A 674 or AWWA C105.
- G. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- H. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- I. Install underground, ductile-iron, special pipe fittings according to AWWA C600.
 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- J. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- K. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

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1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
 - M. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
 - N. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
 - O. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
 - P. Install force mains at elevations indicated.
 - Q. Install engineered controlled-flow storm drainage piping in locations indicated.
 - R. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
 - S. Install PVC storm drainage piping according to ASTM D 2665.
 - T. Install underground PVC storm drainage piping according to ASTM D 2321.
 - U. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- 3.4 JOINT CONSTRUCTION
- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
 - B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 - C. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 - D. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

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- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- F. Grooved Joints: Cut groove ends of pipe and assemble grooved ends of pipes, grooved-end fittings, and grooved-end-piping couplings according to AWWA C606.
- G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Mechanical Vibration Controls and Seismic Restraints."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.

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- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
 - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6: 48 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.
- M. Install supports for vertical PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
- D. Connect force-main piping to the following:

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1. Storm Sewer: To exterior force main or storm manhole.
2. Sump Pumps: To sump pump discharge.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

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2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 22-3405
ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following electric water heaters:
 - 1. Commercial, storage electric water heaters.
 - 2. Water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Product Certificates: For each type of commercial and instantaneous electric water heater, signed by product manufacturer.
- D. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Source quality-control test reports.
- F. Field quality-control test reports.

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- G. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:
 - 1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.
- E. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.

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- c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Period(s): From date of Substantial Completion:
 - a. Commercial Electric Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Three years.
 - B. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights that he may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

- A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
 - 1. Manufacturers:
 - a. Bradford White Corporation.
 - b. HESco Industries, Inc.
 - c. Lochinvar Corporation.
 - d. PVI Industries, LLC.
 - e. Rheem Water Heater Div.; Rheem Manufacturing Company.
 - f. Ruud Water Heater Div.; Rheem Manufacturing Company.
 - g. Smith, A. O. Water Products Company.
 - h. State Industries, Inc.
 - 2. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

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- 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
3. Factory-Installed Storage-Tank Appurtenances:
- a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - 1) Staging: Input not exceeding 18 kW per step.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
4. Special Requirements: NSF 5 construction.
5. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.

2.3 COMPRESSION TANKS

- A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charged from the factory to minimum system-operating pressure at tank.
1. Manufacturers:
 - a. AMTROL Inc.
 - b. Smith, A. O.; Aqua-Air Div.
 - c. State Industries, Inc.
 - d. Taco, Inc.
 - e. Watts Regulator Co.
 2. Construction:

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- a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
- b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
- c. Air-Charging Valve: Factory installed.

2.4 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.
- C. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assemblies that are capable of isolating each water heater and of providing balanced flow through each water heater.
- D. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- E. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 25-psig-maximum outlet pressure, unless otherwise indicated.
- F. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.

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1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
 2. Concrete base construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install seismic restraints for light-commercial and commercial water heaters. Anchor to substrate.
- D. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.
- G. Install thermometer on outlet piping of water heaters. Refer to Division 23 Section "Hydronic Specialties" for thermometers.
- H. Install pressure gage(s) on inlet and outlet of commercial electric water- heater piping. Refer to Division 23 Section "Hydronic Specialties" for pressure gages.
- I. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 23 Section "Valves" for general-duty valves and to Division 23 Section "Hydronic Specialties" for thermometers.
- J. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.
- K. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- L. Install compression tank.
- M. Fill water heater(s) with water.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Mechanical Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 4. Verify that piping system test is complete.
 - 5. Check for piping connection leaks
 - 6. Check for clear relief valve inlets, outlets, and drain piping.
 - 7. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F unless piping system application requires higher temperature.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and instantaneous electric water heaters. Refer to Division 1 Section "Closeout Procedures Demonstration and Training."
- B. Schedule training with Owner, through Architect, with at least seven days advance notice.

END OF SECTION

SECTION 22-4300
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes plumbing fixtures and related components.
- B. Related Sections include the following:
 - 1. Division 22 Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- C. Cooled Water: Cooled potable water produced by water cooler.
- D. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- E. PVC: Polyvinyl chloride plastic.
- F. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.
- G. Tepid: Approximately 85 deg F temperature.
 - 1. Allowable Variation: Plus or minus 5 deg F.

1.4 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

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- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.
- D. Emergency Plumbing Fixtures:
 - 1. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.
 - 2. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Hand Sinks: NSF 2 construction.
 - 2. Plastic Laundry Trays: ANSI Z124.6.

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3. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
4. Vitreous-China Fixtures: ASME A112.19.2M.
5. Water-Closet, Tank Trim: ASME A112.19.5.
6. Emergency Eyewash and Shower Equipment: ANSI Z358.1

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. All public lavatories shall be provided with a mixing valve compliant with ASSE 1070
3. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
4. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
5. Faucet Hose: ASTM D 3901.
6. Faucets: ASME A112.18.1M.
7. Hose-Connection Vacuum Breakers: ASSE 1011.
8. Hose-Coupling Threads: ASME B1.20.7.
9. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
10. NSF Materials: NSF 61.
11. Pipe Threads: ASME B1.20.1.
12. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
13. Supply and Drain Fittings: ASME A112.18.1M.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.
3. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Floor Drains: ASME A112.21.1M.
2. Grab Bars: ASTM F 446.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Off-Floor Fixture Supports: ASME A112.6.1M.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.
- B. Reinforcement: 2-by-4-inch fire-retardant-treated-wood blocking between studs. Fire-retardant-treated-wood blocking is specified in Division 6 Section "Rough Carpentry."

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
 3. Faucet, Laminar-Flow Fittings: Equal to 10 percent of amount of each type and size installed, but not less than 2 of each type and size.
 4. Faucet, Flow-Control Fittings: Equal to 10 percent of amount of each type and size installed.
 5. Supply, Flow-Control Fittings: Equal to 5 percent of amount of each type and size installed.
 6. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but not less than 12 of each type.
 7. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
 8. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
 9. Toilet Seats: Equal to 5 percent of amount of each type installed.
 10. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following requirements apply for product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.
 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.
 3. No manufacturer substitutions shall be allowed without prior written approval from the engineer (5) days before bidding.

2.2 MANUFACTURERS

A. Bathtubs and Showers:

1. Manufacturers:

- a. American Standard, Inc.
- b. Aqua Bath Co., Inc.
- c. Aqua Glass Corp.
- d. Briggs Industries, Inc.
- e. Kohler Co.
- f. Sterling Plumbing Group, Inc.
- g. U.S. Industries, Eljer Plumbingware Div.

B. Carriers, Hose Bibbs and Hydrants, and Shock Absorbers:

1. Manufacturers:

- a. Josam Co.
- b. Leonard Valve Company.
- c. NIBCO Inc.
- d. Sioux Chief Manufacturing Co., Inc.
- e. Smith, Jay R. Mfg. Co.
- f. T & S Brass and Bronze Works, Inc.
- g. Wade
- h. Watts Industries, Inc.
- i. Woodford Manufacturing Co.
- j. Zurn Industries, Inc.

C. Emergency Equipment:

1. Manufacturers:

- a. Bradley
- b. Encon
- c. Guardian

D. Fittings:

1. Manufacturers:

- a. American Standard, Inc.
- b. Chicago Faucet Co.
- c. Delta
- d. Kohler Co.
- e. Leonard Valve Company.
- f. Powers Regulators
- g. Symmons Industries, Inc.
- h. T & S Brass and Bronze Works, Inc.
- i. Zurn Industries, Inc.

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j. McGuire Manufacturing Co., Inc.

E. Fixtures:

1. Manufacturers:

- a. American Standard, Inc.
- b. Crane Plumbing/Fiat Products
- c. Kohler Co.
- d. TOTO USA, Inc.
- e. U.S. Industries, Eljer Plumbingware Div.

F. Flushometer Valves:

1. Manufacturers

- a. Coyne & Delany Co.
- b. Sloan Valve Company
- c. Zurn Industries, Flush Valve Operations

G. Floor Drains, Floor Sinks, and Trench Drains:

1. Manufacturers:

- a. ABT, Inc.
- b. Josam Co.
- c. MIFAB Manufacturing, Inc.
- d. Smith, Jay R. Mfg. Co.
- e. Tyler Pipe; Wade Div.
- f. Watts Industries, Inc.
- g. Zurn Industries, Inc.

H. Laundry Trays:

1. Manufacturers:

- a. Crane Plumbing/Fiat Products
- b. Mustee, E. L. & Sons, Inc.

I. Outlet Boxes:

1. Manufacturers:

- a. Acorn Engineering Company.
- b. Gray, Guy Manufacturing Co., Inc.
- c. Oatey.
- d. Symmons Industries, Inc.
- e. Zurn Industries, Inc.

J. Stainless Steel Sinks:

1. Manufacturers:

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- a. American Standard, Inc.
- b. Elkay Manufacturing Co.
- c. FHP/Kindred
- d. Just Manufacturing Co.
- e. Kohler Co.
- f. U.S. Industries, Eljer Plumbingware Div.

K. Service Basins and Service Sinks:

1. Manufacturers:

- a. Creative Industries
- b. Crane Plumbing/Fiat Products
- c. Kohler Co.
- d. Stern-Williams Co., Inc.
- e. Terrazzo Ware
- f. U.S. Industries, Eljer Plumbingware Div.

L. Toilet Seats:

1. Manufacturers:

- a. Bemis
- b. Beneke
- c. Centoco
- d. Church
- e. Olsonite

M. Trap Seal Primer Valves:

1. Manufacturers:

- a. Precision Plumbing Products, Inc.
- b. Smith, Jay R. Mfg. Co.
- c. Tyler Pipe; Wade Div.
- d. Watts Industries, Inc.
- e. Zurn Industries, Inc.

N. Water Coolers:

1. Manufacturers:

- a. Halsey Taylor
- b. Haws
- c. Oasis
- d. Sunroc

2.3 SOURCE QUALITY CONTROL

- A. Certify performance of plumbed emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine roughing-in for water [and waste] piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-hanging fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

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1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 22 Section "Valves" for general-duty valves.
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- N. Install toilet seats on water closets.
- O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- Q. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- R. Install shower, flow-control fittings with specified maximum flow rates in shower arms.
- S. Install traps on fixture outlets.
 1. Exception: Omit trap on fixtures with integral traps.
 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- T. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- U. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.
- V. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for escutcheons.
- W. Set bathtubs, shower receptors, and service basins in leveling bed of cement grout. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for grout.

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- X. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.
 - Y. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
 - Z. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 - 1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Position roof drains for easy access and maintenance.
 - AA. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
 - BB. Install draining-type ground and ground post hydrants with 1 cu. yd. of crushed gravel around drain hole.
 - 1. Set ground hydrants with box flush with grade.
 - 2. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- 3.3 EMERGENCY PLUMBING FIXTURE INSTALLATION
- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components according to manufacturer's written instructions.

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- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Refer to Division 22 Section "Valves" for general-duty shutoff valves.
 - 1. Exception: Omit shutoff valves on valved supplies to group of plumbing fixtures that includes emergency plumbing fixture.
 - 2. Exception: Omit shutoff valves on supplies to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping.
- F. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for dielectric fittings.
- G. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.
- H. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Refer to Division 22 Section "Drainage and Vent Piping" for piping.
- I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for escutcheons.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.
- E. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
- F. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.

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- G. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- H. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- I. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.
- F. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 FIELD QUALITY CONTROL FOR EMERGENCY FIXTURES

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.
- B. Electrical-Component Testing: After electrical circuitry has been energized, test for compliance with requirements.
 - 1. Test and adjust controls and safeties.

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- C. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- D. Report test results in writing.

3.7 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. For Emergency Fixtures:
 - 1. Adjust or replace fixture flow regulators for proper flow.
 - 2. Adjust equipment temperature settings.

3.8 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.

3.9 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22-6000
MEDICAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All work under the provisions of this specification and drawings shall be performed in strict accordance with NFPA 99C 2002 Edition "Standard on Gas and Vacuum Systems."
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes medical gas piping and related specialties for the following medical gas systems:
 - 1. Medical gas pressure systems:
 - a. Oxygen piping, designated "oxygen."
 - b. Medical compressed-air piping, designated "medical air."
 - c. High-pressure medical compressed-air piping, designated "high-pressure air."
 - d. Nitrous oxide piping, designated "nitrous oxide."
 - e. Nitrogen piping, designated "nitrogen."
 - f. Carbon dioxide piping, designated "carbon dioxide."
 - g. Dental compressed-air piping, designated "dental air."
 - h. Laboratory compressed-air piping, designated "laboratory air."
 - 2. Medical gas suction systems:
 - a. Medical-surgical vacuum piping, designated "medical vacuum."
 - b. Waste anesthetic gas disposal piping, designated "WAGD."
 - c. Dental vacuum (oral evacuation) piping, designated "dental vacuum."
 - d. Laboratory vacuum piping, designated "laboratory vacuum."
- B. Owner-Furnished Material: For installation under this Section.
 - 1. <Insert product.>
- C. Owner will furnish medical gases for medical gas concentration testing specified in this Section.
- D. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gauges" for thermometers and pressure gauges.

2. Division 22 Section "Medical Air and Vacuum Equipment" for compressed-air and vacuum equipment and related accessories.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. D.I.S.S.: Diameter-index safety system.
- C. PTFE: Polytetrafluoroethylene plastic.
- D. TFE: Tetrafluoroethylene plastic.
- E. WAGD: Waste anesthetic gas disposal.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide medical gas and vacuum piping systems that comply with the following NFPA 99, 2002 Edition, level categories:
 1. Level 1: For entire facility with systems where failure of medical gas supply would be immediate and direct life-safety threat to patients. Air and vacuum equipment arrangement must be duplex or redundant.
 2. Level 2: For entire facility with systems where critical life-support equipment for patients is not required. Air and vacuum equipment arrangement may be simplex instead of redundant.
 3. Level 3: For entire facility with limited storage systems for non-critical patient care. Air and vacuum equipment arrangement may be simplex instead of redundant.

1.5 SUBMITTALS

- A. Product Data: For the following:
 1. Medical gas tubes and fittings.
 2. Medical gas valves and valve boxes.
 3. Medical gas manifolds.
 4. Medical gas service connections and pressure control panels.
 5. Medical gas service units. Include integral service connections.
 6. Alarm system components.
 7. Medical gas cylinder storage racks.
 8. Bulk medical gas storage tanks. Include rated capacities and operating weights.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Coordination Drawings: For medical gas systems. Include relationship to other services that serve same work area.

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- D. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.
- E. Piping Material Certification: Signed by Installer certifying that medical gas piping materials comply with NFPA 99 2002 Edition requirements.
- F. Certificates of Shop Inspection and Data Report for Bulk Medical Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code.
- G. Qualification Data: For testing agency.
- H. Field quality-control test reports.
- I. Operation and Maintenance Data: For medical gas piping and specialties to include in emergency, operation, and maintenance manuals. Include data for the following:
 - 1. Medical gas manifolds.
 - 2. Medical gas service connections and pressure control panels.
 - 3. Medical gas service units.
 - 4. Alarm system.
 - 5. Bulk medical gas storage tanks.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the Medical Gas Professional Healthcare Organization or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction. Testing agent and/or agency shall be independent of the medical gas equipment supplier or medical gas equipment manufacturer's representing company. Testing agent and/or agency shall not be the medical gas equipment supplier for the project.
- B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label bulk medical gas storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels."
- E. Comply with NFPA 50, "Bulk Oxygen Systems at Consumer Sites."
- F. Comply with NFPA 70, "National Electrical Code."
- G. Comply with NFPA 99, "Health Care Facilities," 2002 Edition, for materials and installation.

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- H. Comply with NFPA 99C 2002 Edition, "Standard on Gas and Vacuum Systems."
- I. Comply with UL 498, "Attachment Plugs and Receptacles," for electrical service connections.
- J. Comply with UL 544, "Medical and Dental Equipment," for medical gas specialties.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases with concrete work.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quick-Connect Service Connections: Furnish complete noninterchangeable medical gas pressure outlets and suction inlets.
 - a. Oxygen Service Connections: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - b. Medical Air Service Connections: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - c. Nitrous Oxide Service Connections: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - d. Carbon Dioxide Service Connections: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - e. Medical Vacuum Service Connections: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - f. Medical Vacuum Slide Brackets: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - g. WAGD Service Connections: Equal to 20 percent of amount installed, but no fewer than 5 units.
2. D.I.S.S. Connections: Furnish complete noninterchangeable medical gas pressure outlets and suction inlets complying with CGA V-5.
 - a. Oxygen D.I.S.S. No. 1240: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - b. Medical Air D.I.S.S. No. 1160: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - c. Nitrous Oxide D.I.S.S. No. 1040: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - d. Carbon Dioxide D.I.S.S. No. 1080: Equal to 20 percent of amount installed, but no fewer than 5 units.

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- e. Medical Vacuum D.I.S.S. No. 1220: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - f. Medical Vacuum Slide Brackets: Equal to 20 percent of amount installed, but no fewer than 5 units.
 - g. WAGD D.I.S.S. No. 2220: Equal to 20 percent of amount installed, but no fewer than 5 units.
- 3. High-Pressure Air Control Panels: Complete panel with high-pressure air CGA V-5, D.I.S.S. No. 1160, equal to 10 percent of amount installed, but no fewer than 1 units.
 - 4. Nitrogen Control Panels: Complete panel with nitrogen CGA V-5, D.I.S.S. No. 1120, equal to 10 percent of amount installed, but no fewer than 1 units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPES, TUBES, AND FITTINGS

- A. Hard Copper Tube: ASTM B 819, Type K or L, seamless, drawn-temper, medical gas tube that has been factory cleaned, purged, and sealed for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.
 - 1. Fittings: Factory cleaned, purged, and bagged for oxygen service according to CGA Pamphlet G-4.1.
 - a. Copper Pressure Fittings: ANSI B16.22, wrought-copper solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
 - 2. For pipe sizes 3 inches or greater and operating pressures of 185-psig or greater use ASTM B 819, Type K copper piping.
- B. Vacuum Tube: ASTM B 819, Type K or L, seamless, drawn-temper, medical gas tube that has been factory cleaned, purged, and sealed for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in

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green for Type K tube and blue for Type L tube, ASTM B 88, Type K, L, or M, or ASTM B 280 ACR tube.

- C. Memory-Metal Couplings: Nickel-titanium, shape-memory-alloy, cryogenic compression fitting for joining copper tube without heat.
 - 1. Cleaning: Factory cleaned, purged, and bagged for oxygen service according to CGA Pamphlet G-4.1.
 - 2. Available Manufacturers:
 - a. Tubetronics, Inc.
 - b. Smart Technologies

- D. Flexible Pipe Connectors: Corrugated-copper inner tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Cleaning: Factory cleaned, purged, and sealed or bagged for oxygen service according to CGA Pamphlet G-4.1.
 - 2. Working-Pressure Rating: 1000 psig minimum.
 - 3. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 4. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
 - 5. Available Manufacturers:
 - a. ANAMET Inc.
 - b. Flex-Hose Co., Inc.
 - c. Flexicraft Industries.
 - d. Hyspan Precision Products, Inc.
 - e. Mercer Rubber Co.
 - f. Metraflex, Inc.
 - g. Proco Products, Inc.
 - h. Unaflex Inc.

2.3 JOINING MATERIALS

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

- B. Brazing Filler Metals: AWS A5.8, BCuP-5 alloy that contains at least 15 percent silver and has at least 1000 degree F melting point for joining copper to copper.
 - 1. Exception: When joining copper piping to brass or bronze fittings BAg series, cadmium free silver alloy, brazing filler metal and flux shall be permitted.

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- a. On joints NPS ¾ size and smaller, flux coated, cadmium free, BAg series brazing rods shall be permitted to be used.

C. Threaded-Joint Tape: PTFE.

D. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos free, and suitable for oxygen service.

- 1. Manufacturer shall provide documentation stating that gasket material is suitable for oxygen service.

2.4 MEDICAL GAS VALVES

A. Valves, General: Factory cleaned for oxygen service and bagged in accordance with CGA Pamphlet G-4.1.

- 1. Exception: Factory cleaning and bagging are not required for valves for Vacuum or WAGD service.

B. General Duty Shut-off Valves: 3-piece-body, full-port brass or bronze ball valve rated for 600-psig minimum working pressure; with chrome-plated brass ball, PTFE or TFE seats, blowout-proof stem, threaded or solder-joint ends, and a lockable type handle designed for quarter turn between opened and closed positions.

- 1. Include union-type body with bolted swing-away center section.
- 2. Include factory-installed ASTM B 819, Type K copper-tube extensions.
- 3. Available Manufacturers:
 - a. Allied Healthcare Products, Inc.
 - b. Amico Corporation.
 - c. Beacon Medaes Medical Products.
 - d. Squire-Cogswell/Aeros Instruments.
- 4. General Duty Shut-off Valves for Vacuum and WAGD systems are permitted to be ball or butterfly type.

C. Stainless-Steel Ball Valves: MSS SP-72, split-body ball valve rated for 600-psig minimum working pressure; with stainless-steel ball, PTFE or TFE seats, blowout-proof stem, flanged ends, and locking-type handle.

- 1. Available Manufacturers:
 - a. Cooper Cameron Corp.; Copper Cameron Valves Div.
 - b. KTM Products, Inc.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.

D. Bronze Check Valves: Straight-through-pattern, spring-loaded ball check valve; designed for 400-psig minimum working pressure.

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- E. Zone Valves: 3-piece-body, full-port brass or bronze ball valve rated for 600-psig minimum working pressure; with chrome-plated brass ball, PTFE or TFE seats, blowout-proof stem, threaded or solder-joint ends, and handle designed for quarter turn between opened and closed positions.
1. Include union-type body with bolted swing-away center section.
 2. Include factory-installed ASTM B 819, Type K copper-tube extensions with pressure gauge for pressure systems and vacuum gauge for vacuum systems.
 3. Available Manufacturers:
 - a. Allied Healthcare Products, Inc.
 - b. Amico Corporation.
 - c. Beacon Medaes Medical Products.
 - d. Squire-Cogswell/Aeros Instruments.
- F. Zone Valve Boxes: Formed steel for recessed mounting, with holes for medical gas piping and anchors. Include boxes for single- or multiple-valve installation with pressure gauge and in sizes to permit manual operation of valves.
1. Interior Finish: Factory-applied white enamel.
 2. Cover Plate: Anodized aluminum frame capable of adjustment for wall thickness with frangible or removable windows.
 3. Valve-Box Windows: Clear or tinted transparent plastic with center mounted pull ring and labeling that includes rooms served, according to NFPA 99 2002 Edition.
- G. Emergency Medical Gas Connections: Low-pressure medical gas inlet assemblies for connection to building medical gas piping systems.
1. Emergency Oxygen Connection: Include the following:
 - a. Enclosure: Weatherproof hinged locking cover with caption similar to "Emergency Low-Pressure Gaseous Oxygen Inlet."
 - b. Inlet: Factory-installed, NPS 1, ASTM B 819, copper tubing with NPS 1 minimum ball valve and plugged inlet.
 - c. Safety Valve: Bronze-body, pressure relief valve set at 75 psig. Safety valve may be separate for installation in oxygen piping system.
 - d. Instrumentation: Pressure gauge.
 2. Emergency Nitrous Oxide Connection: Include the following:
 - a. Enclosure: Weatherproof hinged locking cover with caption similar to "Emergency Low-Pressure Gaseous Nitrous Oxide Inlet."
 - b. Inlet: Factory-installed, NPS 1, ASTM B 819, copper tubing with NPS 1 minimum ball valve and plugged inlet.
 - c. Safety Valve: Bronze-body, pressure relief valve set at 75 psig. Safety valve may be separate for installation in oxygen piping system.

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- d. Instrumentation: Pressure gauge.
- H. Safety Valves: Brass, Bronze, or Stainless Steel body and set to 50 percent above the normal system operating pressure. Shall be designed and cleaned for oxygen service.
 - 1. Pressure Relief Valves: ASME construction, poppet type. Vent to outside, turn down and screen to prevent water and vermin from entering the piping.
 - 2. Vacuum Relief Valves: Specialty manufacturer's option.
- I. Pressure Regulators: Bronze body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig minimum inlet pressure; and capable of controlling delivered air pressure within 0.5 psig for each 10-psig inlet pressure.
- J. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, 200-psig minimum working-pressure rating, and capable of automatic discharge of collected condensate.

2.5 MEDICAL GAS MANIFOLDS

- A. Available Manufacturers:
 - 1. Allied Healthcare Products, Inc.
 - 2. Amico Corporation.
 - 3. Beacon Medaes Medical Products.
 - 4. Squire-Cogswell/Aeros Instruments.
- B. Description: Manifolds for medical gases that comply with NFPA 99 2002 Edition, Ch. 5, Section "Cylinder Systems without Reserve Supply," for high-pressure medical gas cylinders. Include the following features:
 - 1. Central Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gauges, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, pressure changeover switch, dual line-pressure regulators, dual shutoff valves, and safety valve.
 - 2. Manifold and Headers: Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks. Units include design for 2000-psig minimum inlet pressure, except nitrous oxide manifolds may be designed for 800 psig and carbon dioxide manifolds may be designed for 1500 psig. Include cylinder bank headers with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves with filter, shutoff valve, pressure regulator, check valve, and pressure gauge.
 - 3. Medical Gas Cylinders: Will be furnished by Owner.
 - 4. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder bank header.

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5. Mounting: Wall with mounting brackets for manifold control cabinet and headers.
6. Label manifold control unit with permanent label identifying medical gas type and system operating pressure.
7. Nitrous Oxide Manifolds: 50-psig line pressure, with electric heater or orifice design that will prevent freezing during high demand.
8. Nitrogen Manifolds: 160 to 180-psig line pressure.
9. Oxygen Manifolds: 50-psig line pressure.
10. Medical Air Manifolds: 50-psig line pressure.
11. Carbon Dioxide Manifolds: 50-psig line pressure.
12. High-Pressure Air Manifolds: 200-psig line pressure.

2.6 MEDICAL GAS SERVICE CONNECTIONS

- A. Connection Devices: For specific medical gas pressure and vacuum services listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping, unless otherwise indicated.
1. Available Manufacturers:
 - a. Allied Healthcare Products, Inc.
 - b. Amico Corporation.
 - c. Beacon Medaes Medical Products.
 - d. Hill-Rom.
 - e. Squire-Cogswell/Aeros Instruments.
 2. Roughing-in Assembly:
 - a. Steel outlet box for recessed mounting and concealed piping.
 - b. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed.
 - c. Double seals that will prevent gas leakage.
 - d. ASTM B 819, Type K, NPS 3/8 copper inlet or outlet tube brazed to valve with gas-service marking and tube-end dust cap.
 3. Finishing Assembly:
 - a. Brass housing with primary check valve.
 - b. Double seals that will prevent gas leakage.
 - c. Cover plate with gas-service label.
 4. Quick-Connect Service Connections: With keyed indexing to prevent interchange between services, constructed to permit one-handed connection and

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removal of equipment, and with positive-locking ring that retains equipment stem in valve during use. Include the following:

- a. Oxygen Service Connections: Keyed oxygen outlet.
 - b. Medical Air Service Connections: Keyed medical air outlet.
 - c. Nitrous Oxide Service Connections: Keyed nitrous oxide outlet.
 - d. Carbon Dioxide Service Connections: Keyed carbon dioxide outlet.
 - e. Medical Vacuum Service Connections: Keyed medical vacuum suction inlet.
 - f. Medical Vacuum Slide Brackets: With pattern matching medical vacuum service connection.
 - g. WAGD Service Connections: Keyed WAGD suction inlet.
5. D.I.S.S. Service Connections: CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
- a. Oxygen Service Connections: CGA V-5, D.I.S.S. No. 1240, oxygen outlet.
 - b. Medical Air Service Connections: CGA V-5, D.I.S.S. No. 1160, medical air outlet.
 - c. Nitrous Oxide Service Connections: CGA V-5, D.I.S.S. No. 1040, nitrous oxide outlet.
 - d. Carbon Dioxide Service Connections: CGA V-5, D.I.S.S. No. 1080, carbon dioxide outlet.
 - e. Medical Vacuum Service Connections: CGA V-5, D.I.S.S. No. 1220, medical vacuum suction inlet.
 - f. Medical Vacuum Slide Brackets: With pattern matching medical vacuum service connection.
 - g. WAGD Service Connections: CGA V-5, D.I.S.S. No. 2220, WAGD suction inlet.
 - h. High-Pressure Air Service Connections: CGA V-5, D.I.S.S. No. 1160, high-pressure air outlet.
 - i. Nitrogen Service Connections: CGA V-5, D.I.S.S. No. 1120, nitrogen outlet.
6. Wall Outlet Service Connection Cover Plates: One piece, with permanent coating, color-coded, medical gas identifying label matching corresponding outlets.
7. Vacuum Bottle-Slide Brackets: Bottle-slide and mounting assembly matching pattern of vacuum inlet. Include one slide bracket for each wall-mounting vacuum inlet unless no slide bracket requirement is indicated.

2.7 MEDICAL GAS PRESSURE CONTROL PANELS

- A. Description: Steel box and support brackets for recessed roughing-in with stainless-steel or anodized-aluminum cover plate with printed operating instructions. Include manifold assembly consisting of inlet supply valve, inlet supply pressure gauge, line-pressure control regulator, outlet supply pressure gauge, D.I.S.S. service connection, and piping outlet for remote service connection.
1. Available Manufacturers:
 - a. Allied Healthcare Products, Inc.; Chemetron Div.
 - b. Amico Corporation.
 - c. Beacon Medaes Medical Products.
 - d. Hill-Rom.
 - e. Squire-Cogswell/Aeros Instruments.
 2. Minimum Working Pressure: 160 psig for nitrogen and 200 psig for instrument air.
 3. Line-Pressure Control Regulator: Self-relieving, diaphragm type with precision manual adjustment.
 4. Pressure Gauges: 0- to 300-psig range.
 5. Before final assembly, provide temporary dust shield and U-tube for testing.
 6. Air Control Panels: Label cover plate "Air Pressure Control." Include CGA V-5, D.I.S.S. No. 1160, high-pressure air outlet.
 7. Nitrogen Control Panels: Label cover plate "Nitrogen Pressure Control." Include CGA V-5, D.I.S.S. No. 1120, nitrogen outlet.

2.8 MEDICAL GAS SERVICE UNITS

- A. Available Manufacturers:
1. Allied Healthcare Products, Inc.
 2. Amico Corporation.
 3. Beacon Medaes Medical Products.
 4. Hill-Rom.
 5. Squire-Cogswell/Aeros Instruments.
- B. Hose-Reel Service Assemblies: Individual, concealed, retractable hose-reel units with stainless-steel face plates, steel mounting boxes, factory- or field-fabricated mounting brackets, and color-coded service hoses with adjustable stops and service connections matching hoses. Include 12 feet minimum of conductive CR 1/4- or 5/16-inch- ID medical gas hoses rated for 1000-psig minimum working pressure, and the following service connections:
1. Oxygen Hose: [Quick-connect] [D.I.S.S.] outlet.
 2. Medical Air Hose: [Quick-connect] [D.I.S.S.] outlet.
 3. Nitrous Oxide Hose: [Quick-connect] [D.I.S.S.] outlet.

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4. Carbon Dioxide Hose: [Quick-connect] [D.I.S.S.] outlet.
5. Medical Vacuum Hose: [Quick-connect] [D.I.S.S.] inlet.
6. WAGD Hose: [Quick-connect] [D.I.S.S.] inlet.
7. High-Pressure Air Hose: D.I.S.S. inlet.
8. Nitrogen Hose: D.I.S.S. inlet.
9. Power: L5-20R, locking-type, 20-A, single, power receptacle.

C. Fixed Hose Service Assemblies: Individual, concealed hose connection with stainless-steel face plates, steel mounting boxes, factory- or field-fabricated mounting brackets, and color-coded service hoses with retractor device and service connections matching hoses. Include 72 inches of conductive CR 1/4- or 5/16-inch- ID medical gas hoses rated for 1000-psig minimum working pressure, and the following service hose connections:

1. Oxygen Hose: [Quick-connect] [D.I.S.S.] outlet.
2. Medical Air Hose: [Quick-connect] [D.I.S.S.] outlet.
3. Nitrous Oxide Hose: [Quick-connect] [D.I.S.S.] outlet.
4. Carbon Dioxide Hose: [Quick-connect] [D.I.S.S.] outlet.
5. Medical Vacuum Hose: [Quick-connect] [D.I.S.S.] inlet.
6. WAGD Hose: [Quick-connect] [D.I.S.S.] inlet.
7. High-Pressure Air Hose: D.I.S.S. inlet.
8. Nitrogen Hose: D.I.S.S. inlet.
9. Power: L5-20R, locking-type, 20-A, single, power receptacle.

D. Hose Assemblies intended to handle oxygen at gauge pressures greater than 300 psi, the hose shall contain no polymeric materials.

E. Hose Assemblies intended to handle oxygen or nitrous oxide at gauge pressures of less than 300 psi, material construction shall be compatible with oxygen under the temperatures and pressures to which the components can be exposed in the containment and use of oxygen, nitrous oxide, mixtures of these gases, or mixtures containing more than 23.5 percent oxygen.

2.9 MEDICAL GAS ALARM SYSTEM

A. Available Manufacturers:

1. Allied Healthcare Products, Inc.
2. Amico Corporation.
3. Beacon Medaes Medical Products.
4. Hill-Rom.
5. Squire-Cogswell/Aeros Instruments.

B. Medical Gas Alarm System, General: Compatible alarm panels, remote sensing devices, and other related components as required by NFPA 99C 2002 Edition for Level 1 medical gas alarm systems. Refer to Division 22 Section "Medical Air and Vacuum Equipment" for air compressors and vacuum pumps. Power wiring is specified in Division 26 Sections.

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- C. Components: Designed for continuous service and to operate on power supplied from 120-V ac power source to alarm panels and with connections for 24- or 12-V ac low-voltage wiring to remote sensing devices. Include step-down transformers if required.
- D. Dew Point Monitors: Continuous line monitoring, having panel with gauge or digital display, pipeline sensing element, electrical connections for alarm system, factory- or field-installed valved bypass, and visual and cancelable audio signal for dryer site and master alarm panels. Alarm signals when pressure dew point rises above 39 deg. F at 55 psig.
 - 1. Operation: Chilled-mirror method or hygrometer moisture analyzer with sensor probe.
- E. Pressure and Vacuum Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - 1. Low-Pressure Switches: 0- to 110-psig operating range.
 - 2. High-Pressure Switches: Up to 300-psig operating range.
 - 3. Vacuum Switches: 0- to 29.9-in. Hg range.
- F. Carbon Monoxide Monitors: Panel with gauge or digital display, pipeline sensing element, electrical connections for alarm system, and factory- or field-installed valved bypass. Alarm signals when carbon monoxide level rises above 10 ppm.
- G. Medical Gas Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - 1. Mounting: Recessed installation.
 - 2. Enclosures: Fabricated from minimum 0.047-inch- thick steel, with knockouts for electrical and piping connections.
 - 3. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gauges; and indicators for oxygen, medical air, medical vacuum, nitrous oxide, nitrogen, WAGD, carbon dioxide, and high-pressure air. Alarm signals when the following conditions exist:
 - a. Oxygen: Pressure drops below 40 psig or rises above 60 psig.
 - b. Medical Air: Pressure drops below 40 psig or rises above 60 psig.
 - c. Medical Vacuum: Vacuum drops below 12 in. Hg.
 - d. Nitrous Oxide: Pressure drops below 40 psig or rises above 60 psig.
 - e. Nitrogen: Pressure drops below 160 psig or rises above 180 psig.
 - f. WAGD: Vacuum drops below effective operating limits.
 - g. Carbon Dioxide: Pressure drops below 40 psig or rises above 60 psig.
 - h. High-Pressure Air: Pressure drops below 200 psig or rises above 220 psig.
 - 4. Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gauges; and indicators for oxygen, medical air, and medical vacuum. Alarms signal when the following conditions exist:
 - a. Oxygen: Pressure drops below 40 psig or rises above 60 psig.

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- b. Medical Air: Pressure drops below 40 psig or rises above 60 psig.
 - c. Medical Vacuum: Vacuum drops below 12 in. Hg.
 - d. WAGD: Piped WAGD systems serving anesthetizing locations and other vital life support and critical care areas, if vacuum level drops below effective operating limits.
5. Local Alarm Panels: Separate trouble alarm signals and pressure and vacuum gauges to indicate function of medical gas and vacuum equipment. Include alarm signals at local alarm panels when the following conditions exist:
- a. Medical Air Equipment: Pressure drops below 40 psig or rises above 60 psig, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above 39 deg. F at 55 psig, carbon monoxide level rises above 10 ppm, and high water level is reached in receiver for liquid-ring, medical air compressor systems.
 - b. Medical Vacuum Equipment: Vacuum drops below 12 in. Hg and backup vacuum pump is in operation.
 - c. WAGD Equipment: When backup WAGD pump is in operation.
 - d. Instrument Air Equipment: When backup compressor is in operation, if provided with a backup compressor, dew point rises above -22 deg. F at 200 psig and high water level is reached in receiver for liquid-ring, instrument air compressor systems.
 - 1) For systems with a standby header the following conditions shall activate a local alarm at the compressor site and at the header location:
 - a) Reserve is in operation.
 - b) Just before the reserve supply drops below an average hour's supply indicating supply is low.
6. Master Alarm Panels: Separate trouble alarm signals, pressure and vacuum gauges, and indicators for oxygen, medical air, medical vacuum, nitrous oxide, nitrogen, WAGD, carbon dioxide, and high-pressure air. Include alarm signals at master alarm panels when the following conditions exist:
- a. Oxygen: Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig or rises above 60 psig, changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.
 - b. Oxygen: Pressure downstream from main shutoff valve drops below 40 psig or rises above 60 psig and changeover is made to alternate bank.
 - c. Medical Air: Pressure drops below 40 psig or rises above 60 psig, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above 39 deg. F at 55 psig,

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carbon monoxide level rises above 10 ppm, and high water level is reached in receiver for liquid-ring, medical air compressor systems.

- d. Medical Vacuum: Vacuum drops below 12 in. Hg and backup vacuum pump is in operation.
 - e. Nitrous Oxide: Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig or rises above 60 psig, changeover is made to reserve, reserve is in use, and reserve level is low.
 - f. Nitrous Oxide: Pressure drops below 40 psig or rises above 60 psig and changeover is made to alternate bank.
 - g. Nitrogen: Pressure drops below 160 psig or rises above 180 psig and changeover is made to alternate bank.
 - h. WAGD Equipment: Vacuum level drops below effective operating limits.
 - i. Carbon Dioxide: Pressure drops below 40 psig or rises above 60 psig and changeover is made to alternate bank.
 - j. High-Pressure Air: Pressure drops below 200 psig or rises above 220 psig and dew point is greater than -22 deg. F at 200 psig.
7. Computer Interface Cabinet: Wall-mounting, welded-steel, control cabinet with gasketed door, mounting brackets, grounding device, and white-enamel finish for connection of medical gas system alarms to facility computer. Include factory-installed signal circuit boards, power transformer, circuit breaker, wiring terminal board, and internal wiring capable of interfacing 20 alarm signals.

2.10 MEDICAL GAS CYLINDER STORAGE RACKS

- A. Wall Storage Racks for Medical Gas Cylinders: Fabricate racks with chain restraints for upright gas cylinders as indicated or provide equivalent manufactured wall racks.
- B. Freestanding Storage Racks for Medical Gas Cylinders: Fabricate racks for gas cylinders as indicated or provide equivalent manufactured storage racks.

2.11 BULK MEDICAL GAS STORAGE TANKS

- A. Bulk Medical Gas Storage Tank Systems: Bulk storage tank with connections for alarm system, continuous supply, and reserve supply that will operate only during emergencies, complying with NFPA 99 2002 Edition, "Health Care Facilities."
- B. Controls: Include actuating switch for alarm system connection and means for automatic actuating of reserve supply.
- C. Bulk Medical Gas Storage Tanks: Vertical mounting, double-wall construction with inner vessel fabricated according to ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," for unfired pressure vessels and suitable for medical gas service. Include insulation and vacuum seal between walls. Fabricate outer shell

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from carbon steel with factory-applied manufacturer's standard protective paint finish suitable for exterior installation. Include the following features, specialties, and components:

1. Safety Valves: ASME construction with pressure setting to correspond to tank working pressure and as required for component or system being protected.
 2. Pressure Gauges: For tank pressure and facility service line pressure.
 3. Contents Gauge: High- and low-level indicator with electric signal circuit connection.
 4. Drain Valves: For piping, inner vessel, and outer shell.
 5. Fill Assembly: Fill connection, piping, valves, relief devices, and controls.
 6. Facility Service Assembly: Piping, valves, relief devices, vaporizer, shutoff valve, pressure regulator, line shutoff valve or check valve, and reserve supply connection for connection to building service piping.
 7. Include permanent label showing medical gas type, storage tank capacity, tank pressure rating, vaporizer capacity, and operating instructions.
 8. Liquid Oxygen Storage Tank: Nickel-steel or stainless-steel inner vessel with 250-psig minimum working pressure. Include electric.
 9. Liquid Nitrous Oxide Storage Tank: Steel-alloy inner vessel with 300-psig minimum working pressure. Include electric vaporizer.
- D. Oxygen Reserve Supply: Manifold header for high-pressure cylinders, fabricated from copper-tube or brass pipe and fittings and suitable for pressures up to 4000 psig. Include header inlet connections complying with CGA V-1, with individual inlet check valves, header shutoff valve, header pressure regulator, line shutoff valve or check valve, pressure gauge, and inlet connections for number of cylinders indicated.
- E. Nitrous Oxide Reserve Supply: Manifold header for high-pressure cylinders, fabricated from copper-tube or brass pipe and fittings and suitable for pressures up to 4000 psig. Include header inlet connections complying with CGA V-1, with individual inlet check valves, header shutoff valve, header pressure regulator, line shutoff valve or check valve, pressure gauge, and inlet connections for number of cylinders indicated, and electric heater.
- 2.12 TEST GAS
- A. Description: Oil-free dry nitrogen complying with CGA P-9, for purging and testing of piping.

2.13 IDENTIFICATION

- A. Refer to Division 22 Section "Mechanical Identification" for identification of piping, valves, gauges, alarms, and specialties and for labels for bulk medical gas storage tanks.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Interruption of Existing Medical Gas Service: Do not interrupt medical gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary medical gas service according to requirements indicated:
 - 1. Notify Construction Manager not less than five days in advance of proposed interruption of medical gas service.
 - 2. Do not proceed with interruption of medical gas service without Owner's written permission.

3.2 EARTHWORK

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 CONCRETE BASES

- A. Install concrete bases for medical gas manifolds and bulk storage tanks. Cast anchor-bolt inserts into bases. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for concrete bases and to Division 3 Section "Cast-in-Place Concrete (Limited Applications)" for formwork, reinforcement, and concrete requirements.

3.4 PIPING APPLICATIONS

- A. General: Use pipe, tube, fittings, and joining methods for medical gas piping systems according to the following applications:
- B. Joining New to Existing Copper Tubes NPS 2 and Smaller: Use memory-metal couplings.
- C. Joining of Dissimilar Metal Piping: Use dielectric fittings. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for dielectric fitting types.
 - 1. NPS 2 and Smaller: Use dielectric unions.
 - 2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
 - 3. NPS 5 and Larger: Use dielectric flange kits.

- D. Specialty and Equipment Flanged Connections: Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube.
- E. Interior and Underground Medical Gas Pressure Piping: Use ASTM B 819, Type L, hard copper tube, copper pressure fittings, and brazed joints.
- F. Interior and Underground Medical Gas Piping at Pressures Greater Than 185 psig: Use ASTM B 819, Type K, hard copper tube, copper pressure fittings, and brazed joints.
- G. Interior Medical Vacuum Piping: Use hard copper tube, copper pressure fittings, and brazed joints.
- H. Underground Medical Vacuum Piping: Use soft copper tube, copper pressure fittings, and brazed joints.
- I. Interior WAGD Piping: Use hard copper tube, copper pressure fittings, and brazed joints.
- J. Underground WAGD Piping: Use soft copper tube, copper pressure fittings, and brazed joints.
- K. Underground Protective Conduit: Schedule 80, PVC pipe; Schedule 80, PVC pressure fittings; and solvent-cemented joints.

3.5 MEDICAL GAS VALVE APPLICATIONS

- A. Drawings indicate medical gas valve types to be used. If specific valve types are not indicated, the following requirements apply:
 - 1. Medical Gas Pressure Piping:
 - a. Shutoff Valves NPS 3 and Smaller: Brass or Bronze ball valve.
 - b. Shutoff Valves NPS 4 and Larger: Stainless-steel ball valve.
 - c. Check Valves NPS 3 and Smaller: Bronze.
 - 2. Medical Vacuum Piping:
 - a. Shutoff Valves NPS 3 and Smaller: Brass or Bronze ball valve.
 - b. Shutoff Valves NPS 4 and Larger: Butterfly valve.
 - c. Check Valves NPS 3 and Smaller: Bronze.
 - d. Check Valves NPS 4 and Larger: Cast iron.
 - 3. WAGD Piping:
 - a. Shutoff Valves NPS 3 and Smaller: Brass or Bronze ball valve.
 - b. Shutoff Valves NPS 4 and Larger: Butterfly valve.
 - c. Check Valves NPS 3 and Smaller: Bronze.
 - d. Check Valves NPS 4 and Larger: Cast iron.
 - 4. Zone Valves: With copper-tube extensions and gauge.

3.6 PIPING INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Install supports and anchors according to Division 22 Section "Hangers and Supports" with spacing according to NFPA 99 2002 Edition.
- C. Install thermometers and pressure gauges according to Division 22 Section "Meters and Gauges."
- D. Install flexible pipe connector at each connection to medical air and vacuum equipment.
- E. Install exterior, buried medical gas piping in a continuous and split protective conduit, to allow for inspection of joints, fabricated with PVC pipe and fittings. Do not extend conduit through foundation wall.
- F. Purge medical gas piping, using oil-free dry nitrogen NF, after installing piping but before connecting to service connections, alarms, and gauges.
- G. Mains and branches in medical gas piping systems shall be not less than NPS ½ size.
- H. Mains and branches in medical-surgical vacuum systems shall be not less than NPS ¾ size.
- I. Drops to individual station outlets and inlets shall be not less than NPS ½ size for oxygen, medical air, nitrous oxide, nitrogen, carbon dioxide, and instrument air and NPS ¾ size for medical-surgical vacuum and WAGD.
- J. Run outs to alarm panels and connecting tubing for gauges and alarm devices shall be permitted to NPS ¼ size.

3.7 MEDICAL GAS VALVE INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping and valve installation.
- B. Install valves in locations required by and according to NFPA 99 2002 Edition.
- C. Install shutoff valve at each connection to and from medical gas specialties and equipment.
- D. Install check valves to maintain correct direction of fluid flow to and from medical gas specialties and equipment.
- E. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
- F. Install zone valves and gauges in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

1. Pressure System Valves: Install pressure gauge downstream from valve.
 2. Suction System Valves: Install vacuum gauge upstream from valve.
- G. Install pressure safety and vacuum relief valves where recommended by specialty manufacturers.
- H. Install emergency medical gas connections with pressure relief valve and full-size discharge piping to outside, with check valve downstream from pressure relief valve and with ball valve and check valve in supply main from bulk oxygen storage tank.
- I. Install pressure regulators in piping to reduce pressure.
- J. Install automatic drain valves for specialties and medical air and vacuum equipment that require draining.
- 3.8 JOINT CONSTRUCTION
- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Brazed Joints: Use silver-phosphorus-composition filler metal with 15 percent silver and comply with CDA's "Copper Tube Handbook," Section VII, "Braze Joints"; or AWS D10.13, "Recommended Practices for the Brazing of Copper Pipe and Tubing for Medical Gas Systems."
- C. Arrange for coupling manufacturer's authorized representative to join new copper tube to existing copper tube with memory-metal couplings.
- 3.9 MEDICAL GAS MANIFOLD INSTALLATION
- A. Install medical gas manifolds on concrete base anchored to substrate.
- B. Install medical gas cylinders and connect to manifold piping.
- C. Install medical gas manifolds with seismic restraints as indicated.
- 3.10 MEDICAL GAS SERVICE CONNECTION INSTALLATION
- A. Install medical gas service connections, of types indicated, in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- B. Install medical gas service connections, of types indicated, in medical gas service units.
- 3.11 MEDICAL GAS ALARM SYSTEM INSTALLATION
- A. Install medical gas alarm system components in locations required by and according to NFPA 99C, 2002 Edition and manufacturer's written instructions.
- B. Install medical gas alarm panels and computer interface cabinet where indicated.

- C. Install medical gas anesthetizing-area, area, and master alarm panels.
- D. Install medical gas local alarm panels at source equipment.
- E. Install computer interface cabinet with connection to medical gas alarm system.

3.12 MEDICAL GAS CYLINDER STORAGE RACK INSTALLATION

- A. Install medical gas cylinder storage racks as indicated.

3.13 BULK MEDICAL GAS STORAGE TANK INSTALLATION

- A. Install bulk medical gas storage tanks and reserve supply tanks level on concrete bases. Set tanks and connect medical gas piping to tanks according to applicable requirements in NFPA 50 for bulk oxygen storage systems. Install tanks level and plumb, firmly anchored to concrete bases; maintain NFPA 50 and tank manufacturer's recommended clearances. Orient tanks so controls and devices are accessible for servicing.
 - 1. Concrete bases are specified in Division 22 Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.
- B. Install bulk medical gas storage tanks and reserve supply tanks with seismic restraints as indicated.

3.14 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to specialties and equipment to allow service and maintenance.
- C. Connect medical gas piping to specialties, equipment, and accessories.
 - 1. Connection NPS 2 and Smaller: With shutoff valve and copper union.
 - 2. Connection NPS 2-1/2 and Larger: With shutoff valve and cast-copper-alloy flange.
- D. Ground specialties and equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.15 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for medical gas piping systems according to NFPA 99. Refer to Division 22 Section "Mechanical Identification" for labeling and identification materials.
- B. Captions and Color-Coding: Use the following or similar medical gas captions and color-coding for medical gas piping products where required by NFPA 99 2002 Edition:
 - 1. Oxygen: White letters on green background or green letters on white background.
 - 2. Medical Air: Black letters on yellow background.
 - 3. High-Pressure Air: Black letters on yellow background with system pressure indicated.
 - 4. Nitrous Oxide: White letters on blue background.
 - 5. Nitrogen: White letters on black background.
 - 6. Carbon Dioxide: Black or white letters on gray background.
 - 7. Dental Air: Black letters on yellow-and-white diagonal-striped background.
 - 8. Medical Vacuum: Black letters on white background.
 - 9. WAGD: White letters on purple background.
- C. Label medical gas systems operating at other-than-standard pressure with system operating pressure.
- D. Install continuous detectable underground warning tapes during backfilling of trenches for exterior underground medical gas piping. Locate tapes below finished grade, directly over piping. Refer to Division 2 Section "Earthwork" for underground warning tapes.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Inspect, test, and certify completed medical gas systems according to requirements in NFPA 99 2002 Edition. Inspect, test, and certify each medical gas piping system, including specialties, service connections, alarm system, safety devices, and source equipment.
 - a. Bulk Oxygen Storage Systems: Comply with NFPA 50.
 - b. Bulk Nitrous Oxide Storage Systems: Comply with CGA G-8.1.
 - 2. Provide oil-free dry nitrogen, medical gases, materials, and equipment required for testing.
 - 3. Level 1 Pressure Medical Gas Testing: Use oil-free dry nitrogen, unless otherwise indicated, and perform procedures and tests as indicated in NFPA 99

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2002 Edition performance and testing paragraphs for piped gas systems. Include the following:

a. Performance Testing:

- 1) Blow Down: Clear piping before connecting service connections or outlets.
- 2) Initial Pressure Tests: Subject each piping section to test pressure of 1.5 times system working pressure, but not less than 150 psig, before attaching system components, after installing station outlets with test caps (if supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water. Repair leaks with new materials and retest systems.
- 3) Cross-Connection Tests: Determine that no cross connections of piping systems exist. Disconnect all systems except system to be checked. Pressurize system to 50 psig. Verify that gas flow from service connections and outlets is only from system being checked. Repeat for each system. Verify correct labeling.
- 4) Purge Tests: Perform heavy intermittent purging of piping and full-flow purging of service connections.
- 5) Standing-Pressure Tests: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test at 20 percent above normal line pressure. Verify that pressure differences comply with required calibration. Repair leaks with new materials and retest systems.

b. System Verification:

- 1) Cross-Connection Tests: Repeat cross-connection test above or perform alternate tests with each gas at different pressure.
- 2) Flow Tests: Perform flow test at each outlet.
- 3) Valve Tests: Verify proper valve operation.
- 4) Alarm Tests: Operate systems and verify proper warning indication of each medical gas piping system function.
- 5) Piping Purity Tests: Test for dew point and hydrocarbons as compared to source gas.
- 6) Final Tie-End Tests: Verify that above tests have been successfully performed.
- 7) Operational Pressure Tests: Use designated system gases and test for pressure and flow.

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- 8) Medical Gas Concentration Tests: Test each gas for required concentration.
 - 9) Labeling: Verify correct labeling.
4. Level 1 Vacuum System Testing: Use oil-free dry nitrogen, unless otherwise indicated, and perform procedures and tests as indicated in NFPA 99 2002 Edition performance and testing paragraphs for piped vacuum systems. Include the following:
- a. Blow Down: Clear piping before connecting service connections or inlets.
 - b. Initial Pressure Tests: Subject each piping section to test pressure not less than 150 psig before attaching system components, after installing station outlets with test caps (if supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water. Repair leaks with new materials and retest systems.
 - c. Initial Cross-Connection Tests: Determine that no cross connections of piping systems exist. Disconnect all systems except system to be checked. Pressurize system to 50 psig. Verify that gas flow from service connections and outlets is only from system being checked. Repeat for each system. Verify correct labeling.
 - d. Standing-Pressure Tests: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test at not less than 60 psig.
 - e. Final Cross-Connection Tests: Repeat cross-connection test above or perform alternate tests with each system at different pressure.
 - f. Vacuum Tests: Verify functional operation of components.
 - g. Valve Tests: Verify proper valve operation.
 - h. Alarm Tests: Operate systems and verify proper warning indication of each medical gas piping system function.
 - i. Labeling: Verify correct labeling.
5. Test and adjust controls and safeties.
- C. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
1. Inspections performed.
 2. Procedures, materials, and gases used.
 3. Test methods used.
 4. Results of tests.

3.17 PROTECTION

- A. Protect factory cleaned piping and fittings from dirt, debris, oils, grease, and damage.
- B. Keep factory shipping plugs in medical gas piping until such time it is being installed.
- C. Keep factory cleaned fittings in shipping bags until such time that they are to be installed.
- D. Place clean plugs in ends of uncompleted piping at the end of each day or when work stops.

3.18 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain medical gas alarm system and bulk medical gas storage tanks. Refer to Division 1 Section "Closeout Procedures Demonstration and Training."

END OF SECTION

SECTION 22-6005
MEDICAL VACUUM EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following medical air and vacuum equipment and related accessories for healthcare facilities:
 - 1. Rotary Claw medical vacuum pumps and receivers.
- B. Related Sections include the following:
 - 1. Division 22 Section "Medical Gas Piping" for compressed-air and vacuum piping, valves, alarms, and related specialties.

1.3 DEFINITIONS

- A. Expanded Air: Air delivered from vacuum pumps and turbine exhausters. Flow rate is delivered expanded air measured in ecfm.
- B. Standard Air: Free air at 68 deg F and 1 atmosphere (29.92 in. Hg) before compression or expansion and measured in scfm.
- C. WAGD: Waste anesthetic gas disposal.

1.4 PERFORMANCE REQUIREMENTS

- A. Medical vacuum equipment shall comply with the following NFPA 99 level categories:
 - 1. Level 1: For entire facility with systems where failure of medical gas supply would be immediate and direct life-safety threat to patients. Compressed-air and vacuum equipment arrangement must be redundant (duplex or multiplex).

1.5 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following medical air and vacuum equipment:
 - 1. Vacuum pumps, including receivers and outlet filters.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.

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1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
 3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Product Certificates: Certificates of shop inspection and data report for receiver tanks as required by ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. Manufacturer Seismic Qualification Certification: Submit certification that medical air and vacuum equipment, accessories, and components will withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Qualification Data: For Installer.
- F. Startup service reports.
- G. Operation and Maintenance Data: For the following medical air and vacuum equipment and accessories to include in emergency, operation, and maintenance manuals:
1. Vacuum pumps.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: An authorized representative of medical air and vacuum equipment manufacturer for both installation and maintenance of units required for this Project.

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- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of medical air and vacuum equipment and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label receiver tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. Comply with NFPA 70, "National Electrical Code."
- F. Comply with NFPA 99, "Health Care Facilities," for materials and installation.
- G. Comply with UL 544, "Medical and Dental Equipment."

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for concrete bases. Refer to Division 3 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PACKAGED MEDICAL VACUUM PUMPS AND RECEIVERS

- A. Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty vacuum pump and receivers.
- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
 - 1. Mounting and Wiring: Factory installed and connected as an integral part of equipment package.
 - 2. Enclosure: NEMA ICS 6, Type 12 control panel, unless otherwise indicated.
 - 3. Motor Controllers: Full-voltage, combination-magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.

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- a. Control Voltage: 120-V ac or less, using integral control power transformer.
 - b. Motor Overload Protection: Overload relay in each phase.
 - c. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
 - 1) Automatic control switches to alternate lead-lag vacuum pumps for duplex vacuum pumps.
 - 2) Single variable speed drive.
 - 4. Instrumentation: Include receiver vacuum gage, inlet-line vacuum gage, hour meter, discharge-air and coolant temperature gages, and control transformer.
 - 5. Alarm Signal Device: For connection to master alarm panels to indicate when backup vacuum pump is operating.
- C. Motors: Comply with requirements in Division 23 Section "Motors."
- D. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1; and bearing appropriate code symbols. Include vacuum relief valve, vacuum gage, and automatic drain.
- E. Fabricate base and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.3 CLAW O2 ASSURED MEDICAL VACUUM PUMPS

- A. Manufacturers:
- 1. Amico Corporation
 - 2. Beacon Medaes
 - 3. Ohio Medical
- B. Description: Duplex, claw-type, medical vacuum pump unit for medical vacuum and WAGD systems.
- 1. Vacuum Pump(s): Direct driven, non-contacting, variable speed drive claw type.
 - a. Mounting: Freestanding, Base Mount.
 - b. Number of Vacuum Pumps: Two.
 - c. Inlet filters.
 - d. Vacuum Produced: 26 in. Hg.

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- e. Coupling: Non-lubricated, flexible type.
 - f. Cooling/Lubrication System: Unit-mounted, air-cooled exchanger package pre-piped to unit; with air pressure circulation system with coolant stop valve, full-flow coolant filter, and thermal bypass valve.
 - g. Air/Coolant Receiver and Separation Systems: 150-psig- rated steel tank with ASME safety valve, coolant-level gage, multistage air-coolant separator element, minimum pressure valve, blowdown valve, discharge check valve, coolant stop valve, full-flow coolant filter, and thermal bypass valve.
 - h. Capacity Control: Capacity modulation between 0 and 100 percent vacuum delivery. Include necessary control to hold constant vacuum. When vacuum demand is zero, unload unit by using vacuum switch and blowdown valve.
 - i. Outlet silencers on discharge connections.
- 2. Receiver: ASME construction steel tank.
 - a. Orientation: Vertical arrangement.
 - b. Pressure Rating: 100 psig minimum and suitable for vacuum produced by vacuum pump(s).
 - 3. Miscellaneous Devices: Safety valves, inlet-line vacuum gages, and shutoff valves.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean equipment, accessories, and components that have not been cleaned for oxygen service and sealed or that are furnished unsuitable for medical and dental applications, according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."

3.2 CONCRETE BASES

- A. Install concrete bases for medical air and vacuum equipment. Concrete base is specified in Division 23 Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

3.3 EQUIPMENT INSTALLATION

- A. Install medical vacuum equipment according to NFPA 99.
- B. Install medical vacuum equipment on concrete bases. Set and connect units according to manufacturers' written instructions. Install units level, plumb, and anchored to

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substrate in locations indicated. Maintain manufacturers' recommended clearances. Orient equipment so controls and devices are accessible for servicing.

1. Anchor packaged equipment to concrete base according to manufacturers' written instructions and seismic criteria applicable to Project.
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 - b. Install epoxy-coated anchor bolts for supported equipment; extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - C. Vibration Isolation: Install restrained-spring isolators. Vibration isolation devices and installation requirements are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."
 - D. Vibration Isolation: Mount equipment on a vibration isolation equipment base as specified in Division 23 Section "Mechanical Vibration and Seismic Controls."
 - E. Maintain manufacturer's recommended clearances for service and maintenance.
 - F. Install the following devices on medical vacuum equipment:
 1. Thermometer, Vacuum Gage, and Vacuum Relief Valve: Install on each vacuum receiver and separator.
 2. Automatic Drain Valves: Install on vacuum receiver tanks and separators. Discharge condensate over nearest floor drain.
- 3.4 CONNECTIONS
- A. Piping installation requirements are specified in other Mechanical Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - B. Install piping adjacent to equipment to allow service and maintenance.
 - C. Connect piping to vacuum pumps, and receivers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible

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connectors and their installation are specified in Division 23 Section "Basic Mechanical Materials and Methods."

- D. Connect medical vacuum equipment to medical gas alarm system. Refer to Division 22 Section "Medical Gas Piping" for alarm system.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
- F. Connect wiring according to Division 26 Section "Conductors and Cables."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for medical air and vacuum equipment according to NFPA 99. Refer to Division 23 Section "Mechanical Identification" for labeling and identification materials.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to test, inspect, and adjust components and equipment installation and to perform startup service.
- B. Perform the following final checks:
 - 1. Verify that specified tests of piping systems are complete.
 - 2. Verify that potable-water supply connections to equipment have correct backflow preventer.
 - 3. Check for piping connection leaks.
 - 4. Check for lubricating oil in lubricated-type equipment.
 - 5. Check belt drives for proper tension.
 - 6. Verify that vacuum equipment filters and piping are clear.
 - 7. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
 - 8. Check vacuum relief valves for correct settings.
 - 9. Check for proper seismic restraints.
 - 10. Test operation of equipment safety controls and devices.
 - 11. Drain receiver tanks.

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12. Drain separators and add disinfectant.

- C. Verify that medical vacuum equipment is installed and connected according to the Contract Documents.
- D. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements in Division 26 Sections.
- E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- G. Complete installation and startup checks according to manufacturer's written instructions.
- H. Prepare written report documenting testing procedures and results.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain medical air and vacuum equipment. Refer to Division 1 Section "Closeout Procedures Demonstration and Training."

END OF SECTION

SECTION 23-0100
HVAC GENERAL PROVISIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This project is expected to be funded in whole or in part using funds from the American Recovery and Reinvestment Act (ARRA). Section 1605 of the ARRA prohibits the use of these funds unless all iron, steel, and manufactured goods are produced in the United States. All iron and steel manufacturing processes must take place in the United States, except for metallurgical processes involving refinement of steel additives. There is no requirement for the origin of components and subcomponents of manufactured goods. Products listed at 48 CFR 25.104(a) have been determined to be unavailable in the United States and if required for the project may be purchased from foreign sources. No unauthorized use of foreign iron, steel, and/or manufactured goods will be allowed on this project
- B. Provide all labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents.
- C. Principal features of work included are:
 - 1. Heating, ventilating, and air-conditioning system.
 - 2. Complete control system including low voltage wiring.
 - 3. Excavation and backfilling related to mechanical scope of work.
 - 4. Flashing of pipes where they penetrate outside walls.
 - 5. Mechanical systems commissioning.
 - 6. Seismic bracing and anchorage for equipment, ductwork, and piping.
 - 7. Demolition of existing equipment, ductwork, and/or piping.
 - 8. Complete equipment, ductwork, and piping systems shop drawings. The composite coordination drawings shall include mechanical, plumbing, structural, electrical, communications systems, and fire sprinkler information so as to ensure an integrated installation.

1.2 RELATED WORK: The following work shall be furnished under other Divisions.

- A. The related electrical work is covered in Division 26, Electrical. Electrical power shall be provided and installed under the Electrical Division. Starters and disconnects shall be furnished and installed under Electrical Division, unless noted otherwise in specific sections of that specification or as noted on Division 23 plans..
- B. Painting including piping shall be done under the Painting Division.
- C. Flashing of ducts and pipes into roofs shall be done under Architectural Division.

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- D. Holes, chases and recesses required for mechanical work, where advance notice is given the Contractor.
- E. Miscellaneous steel work, such as equipment supports and framed openings for piping and duct.
- F. Access panels and door grilles shall be installed under other Divisions.
- G. Owner-furnished equipment shall be installed by other Divisions.
- H. Openings in casework shall be provided by Casework Manufacturers.
- I. Provide necessary seismic hangers, vibration isolators, equipment mounts, etc. as required to accommodate all seismic protection requirements for all of the mechanical and plumbing work associated with this project per International Building Code requirements, along with any local codes or code amendments. Refer to structural documents for specific seismic parameter guidelines applicable to this project, and provide for accordingly. Provide shop drawings noting locations of all seismic devices, types of seismic required, and seismic device calculations signed and sealed by a qualified Professional Engineer, and to meet all local, and state code requirements related to seismic protection in effect on the date bids are received. Provide a certification from the manufacturer's Seismic Design Engineer that the final installed seismic devices will comply with all applicable code requirements. Equipment manufacturers shall provide certification that their equipment is capable of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic devices. Seismic protection devices shall be as manufactured by Amber/Booth Company, Inc.; Mason industries, Inc.; or Kinetics Noise Control, Inc

1.3 Shop Drawings:

- A. Control systems.
- B. Underground steam distribution and chilled water system.
- C. Owner furnished equipment rough-in layouts.
- D. Kitchen equipment rough-in layouts.
- E. Fire protection system.
- F. Kitchen hood and grease exhaust ductwork systems.
- G. Firestop systems.

1.4 SYSTEM COMMISSIONING

- A. Comply with the requirements of Section 23 08 00 for the commissioning of the mechanical and electrical systems.

PART 2 - PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT: Provide materials and equipment of domestic manufacture bearing the U.L. label when such label is available.

PART 3 - EXECUTION

3.1 AIR HANDLING UNIT STARTUP

- A. Where units have final cartridge filter, units shall not be started until final filters have been installed. Units shall not be started during construction for temporary cooling without final filters in place or the entire duct system shall be cleaned.

3.2 COORDINATION

- A. Coordinate locations of equipment, ductwork, and piping to eliminate conflict with other divisions.
- B. Carefully examine contract documents to be thoroughly familiar with items that require mechanical connections and coordination.
- C. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, changes in elevations, interferences, etc. Make necessary changes in the work, equipment locations, etc. as part of the contract to accommodate work to obstacles and interferences encountered. Before installing, verify exact location and elevation at work site.
- D. Coordinate work with other trades and determine route or location of each duct, pipe, conduit, etc., before fabrication and installation.
- E. Field verify all existing conditions prior to bidding and verify no conflicts exist. Notify engineer and architect if any discrepancies are found. Any tie in points (piping, or duct) shall be field verified for their exact location. No additional costs will be accepted due to the lack of verification prior to bidding.
- F. Provide proper chases and openings. Place sleeves and supports prior to pouring concrete or installation of masonry.

3.3 CUTTING AND PATCHING

- A. Repair or replace routine damage caused by cutting.
- B. Correct unnecessary damage caused due to installation of mechanical work.
- C. Perform repairs with materials that match existing in accordance with the appropriate section of these specifications.

- 3.4 CONNECTION TO EQUIPMENT: Rough-in and connect to kitchen equipment and Owner furnished equipment and provide a shutoff valve and union at each connection. Provide steam strainer and steam trap for steam equipment. Operating valves and/or controls for this equipment will be provided as an integral part of the equipment.

3.5 TRENCHING, EXCAVATING, AND BACKFILLING

- A. Provide trenching, excavation, and backfilling necessary for performance of mechanical work.
- B. Excavate to a depth at least 6" below bottom of pipe and a minimum of 36" above top of pipe. Fill below pipe, around pipe, and minimum of 12" above pipe with sand or Class "B" crushed stone tamped firm and even. Provide topsoil for final layer of dirt (12" minimum). Provide 6" spacing between pipes and between pipe and trench sides. Hand-grade with batterboards placed every 25'. Backfill by hand. Do not use rock or stone above sand or Class "B" crushed stone.

3.6 IDENTIFICATION

- A. Identify exposed or accessible piping with stenciling contents indicating pipe contents and direction of flow on piping not more than 30 feet apart, at valves, at access panels, and at least once above each space.
- B. Sprinkler and buried lines need not be marked.
- C. Identify all mechanical equipment with engraved brass, aluminum, or stainless steel nameplates or tags. Use equipment names and numbers appearing in schedules on drawings. Fasten nameplates to equipment using screws. Glue or adhesive is not acceptable. Fasten tags to equipment using brass, aluminum or stainless steel chains.
- D. Identify each valve with engraved brass, aluminum, or stainless steel identification tag indicating valve service and sequential identification number. Attach tag to valve handle with brass, aluminum or stainless steel chain. Provide two bound manuals to Owner listing each valve sequentially and indicating valve manufacturer, style, size, service, normal position, and specific location for each valve.
- E. Frame and mount control diagrams and sequences in each equipment room. Use non-fading black and white prints encased in aluminum frame with plexiglass cover.
- F. No stenciling or labeling shall be performed until all painting required under architectural section has been performed.

3.6 PIPE CLEANING

- A. The system cleaning and testing described herein are minimum requirements. Additional tests as required by the authority having jurisdiction shall also be performed.
- B. Piping and related items such as valves, etc., shall be inspected for sharp edges or other hazardous conditions. Such conditions shall be corrected by removal, modification or covering.
- C. Before final inspection, the HVAC piping systems shall be thoroughly cleaned. Equipment, pipe, valves, fixtures, and fittings shall be cleaned of grease, piping compound, metal cuttings, plaster, concrete, and other foreign material.

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- D. Factory applied prime coat paints shall be touched up to cover bare places and scratches. Weld joints shall be cleaned and painted with rust inhibitive paint, Galvcon, or approved equal, where galvanized pipe has been welded.
- E. HVAC water piping shall be cleaned by flushing, draining, and refilling until system is free of construction dirt and scale, and water flows clear.
- F. Steam lines shall be cleaned by wasting condensate to the sewer, until no grease appears in the condensate.
- G. After pipe cleaning is complete, strainer baskets shall be removed, cleaned, and replaced. Conical or disc type strainers shall be used during flush procedure at flanged connections upstream of pocket areas, shall be cleaned between flushes, and removed at completion of flushing procedure.
- H. Hot water heating and chilled water lines shall be thoroughly flushed before installation of control valves by installing temporary flushing loops or spool pieces at valve locations.

3.7 PIPE TESTING

- A. Testing shall be completed before insulation and concealment is started.
- B. All tests shall apply full test pressure to the piping for a minimum of twenty-four hours unless otherwise noted in specifications.
- C. All domestic water piping shall be tested at 125 pounds per square inch. All Hydronic, steam and condensate piping shall be tested at 150 pounds per square inch. All other piping shall be tested at 1 ½ times the working pressure
- D. When the test pressure has fallen over five percent during the twenty-four hour test period, the point of leakage shall be found, repaired and the test repeated. This procedure shall be followed until the piping system has been proven absolutely tight.
- E. The use of chemicals or so-called stop-leak compounds will not be permitted at any time.
- F. When delicate control mechanisms and other items having a rating less than the test pressure are installed in the piping system, they shall be removed during the tests to prevent shock damage. This does not apply to control valves.
- G. Leaks and other defects shall not be repaired by mastic or other temporary means. All leaks shall be repaired by removal of the valve, fitting joint, or section that is leaking and reinstalling new material with joints as specified hereinbefore.
- H. Piping may be tested a section at a time to facilitate construction. All gauges and instrumentation used shall have been recently calibrated in accordance with manufacturer's recommendations.

END OF SECTION

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Enfinity Engineering

November 21, 2003
Reissued March 26, 2004

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SECTION 23-0104
HVAC BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work required under this section of the specifications consists of basic materials and methods applicable to work under Division 23.

1.2 QUALITY ASSURANCE

- A. Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.
- B. Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTIONS: Provide double sphere, neoprene flexible pipe connectors with flanged or union connections as manufactured by Metraflex or approved substitute in the following locations.

- A. Piping connections to pumps.
- B. Piping connections to air handling units.
- C. Piping connections to fan coil units.
- D. Piping connections to chillers.
- E. Piping connections to cooling towers.

2.2 V-BELT DRIVES

- A. Provide all fan drives with V-belts rated for 150% of nameplate motor horsepower. Provide adjustable pitch motor sheaves for motor sizes through 20 hp. For motor sizes 25 hp and larger provide fixed pitch motor sheaves after balancing to within plus 5% of design air quantity. Select motor sheaves so centerline does not extend past end of motor shaft and such that motor bearing grease fitting and relief port is not obstructed.
- B. Provide belt guards for all belt driven equipment. Provide expanded metal cover with access to driven shaft for tachometer.

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2.3 FOUNDATIONS AND PADS

- A. Provide foundations, pads, and bases required for equipment. Concrete to be in accordance with concrete division of specifications.
- B. Coordinate proper sizes and locations of foundations, pads, bases, louvers, anchors, supports, and other items to be built into structure.

2.4 FASTENINGS TO STRUCTURES

- A. Provide structural fastening devices for equipment, materials, piping and ductwork. Devices to be concrete inserts, expansion shields and lag bolts, and through bolts-washers-nuts. All bolted devices to use jamb nuts. Inserts to be continuous type as manufactured by Unistrut or approved substitute. Install per manufacturer's published installation instructions in lengths to suit specific application, complete with spring nuts, end caps, and plastic coated filler to prevent concrete seepage.
- B. Use of power drive "shot-pins" is permitted only for ducts 20" in width and smaller and single pipes 1" and smaller.

2.5 ACCESS PANELS

- A. Provide ceiling and wall access panels for installation by other Divisions. Coordinate locations so panels will provide proper access to equipment served. Notify Designer of proposed wall or ceiling access panel locations prior to installation of such panels. Minimum size: 24" x 24".
- B. Panels shall be manufactured by Bilco or approved substitute. Provide panels with minimum 16 gauge steel construction with screwdriver operated locks and primer finish.
- C. Provide fire-rated panels for installation in fire-rated partitions.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Substitutions shall be reviewed by the Engineer as covered under "Submittals".
- B. The mechanical drawings are diagrammatic and show the relations of equipment and connections and shall not be construed to be complete as to the exact requirements.
- C. Installation of equipment and materials shall be performed in accordance with manufacturer's recommendations or contract documents, whichever is more stringent. Installation of equipment and routing of systems shall be coordinated with other work so as to prevent delays, conflicts or damage.

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- D. Duct, piping and other suspended equipment shall be installed so as to provide the maximum possible clearance underneath except as noted.
- E. Equipment and devices, which require service, shall be installed to provide the necessary clearance as recommended by the manufacturer.
- F. Work, equipment and materials shall be protected from theft, injury, weather and other damage at all times. Open ends of duct, pipe and other work shall be protected by suitable plugs or covers during storage and construction to prevent entrances of dirt or other foreign material.
- G. The Engineer shall be notified in writing of any conflicts in contract documents. Conflicts shall be resolved by a written ruling from the General Contractor.
- H. Unless indicated by drawings or specifically approved, all items in the same section shall be by the same manufacturer (e.g. air handlers, pumps, etc.)

END OF SECTION

Pre-Functional Checklist

RTU/AHU #	OK	N/A
FANS AND CASING SECTIONS		
Spring isolators installed and not bottomed out.		
Motor rotation correct and free fan wheel rotation.		
Motor belts aligned and properly tensioned.		
Proper starter/VFD installed and labeled. Verify division 16 power wiring installed.		
Bearing races secured tight to fan shaft.		
Bearing grease cert fitting accessible and lubricated.		
All bolts, fasteners, and set screws checked & tightened.		
At full speed, Fans have no unusual noise or vibration.		
All safety guards are properly installed.		
Access doors close tightly, door gaskets installed. Doors meet proper applications low/med pressure		
Casing/duct sealed with proper sealant.		
Proper insulation installed on casing duct, and joints sealed.		
No evidence of air escaping unit or insulation ballooning w/fans on.		
No evidence of negative machine room pressure w/fans operating, Toilet paper test.		
Fan air volume measuring device installed - check for tight installation - no movement.		
Duct safety static pressure sensor installed at proper location and wired to start circuit.		
Flex connection at fan discharge installed and aligned with duct and unit opening.		
Condensate drain trapped properly and run to floor drain with proper slope and trap dimensions.		
Manufacturer's required clearances for unit/components maintained.		
Dampers/actuators properly installed & close tightly.		
Damper linkage checked for binding, min. play & right blades.		
Required maintenance clearances maintained.		
Filters installed tightly and checked for no bypass. Carefully inspect seals/gasket on final filters.		
Metal spacers installed in filter rack.		
Filter manometers installed and calibrated.		
Air handler control system operational. Power wiring to controls.		
System labeling per specifications.		
Associated fire dampers and fire/smoke dampers are operational.		
Louvers installed for outside air.		
Built-up sections of units are in the proper locations. Plenums and additional sections sealed.		
Does the supply fan require emergency power? Verify electrical installation.		
CHILLED WATER COILS:		
Coils clean and fins in good condition.		
No open area around coil for air bypass.		
Coil piped for counter flow.		
Chilled water pipe complete and piping properly supported.		
Chilled water pipe is properly insulated and labeled.		
Chilled water pipe pressure test complete and no leaks.		
Air bleed valves with caps installed.		
Strainers, drain valve, hose bib and cap installed.		
Dirt leg drain valve w/hose bib connections & caps installed.		
Piping, valves, and clearances accommodate coil removal.		
Balance valve and isolation valves properly installed.		
Control valves properly installed.		
Pilot positioner installed on control valve actuator if required.		

Pre-Functional Checklist

CHILLER #		
	OK	N/A
Isolation valves installed.		
Pipes properly supported & not supported by chiller.		
Refrigerant relief vented outside and rain protected.		
Relief piping weight not bearing on rupture disc.		
Adequate space for tube pull.		
Unit has proper insulation type and thickness.		
Piping and insulation is complete and undamaged.		
Flow direction is indicated on chilled and condenser water lines.		
Insulation is installed where condensation may occur.		
Pressure gauges are installed across evaporator and condenser.		
Thermometers are installed across evaporator and condenser.		
Evaporator and condenser heads removed, inspected, and trash free.		
Vibration isolation pads installed.		
Flow Switches and or Differential Switches Installed		
Drain valves piped to floor drain.		
Control wells installed.		
Oil cooler piped.		
Clearances have been maintained and piping is installed for service.		
Chilled and Condenser water connections to chiller are correct.		
Chilled and Condenser pumps are interlocked to chiller in auto mode.		
CT fans enabled when chiller is in auto mode.		
Factory representative start-up completed and documented.		
Piping and equipment labeling per specifications.		
Refrigeration alarm system is operational.		
Division 16 wiring complete.		
Chiller Comments:		
Approval:		
Date:		
Superintendent Signature:		

Pre-Functional Checklist

Exhaust / Supply Fan		
Fans and Casing Sections	OK	N/A
Fan properly supported and installed per details		
Fan secured to Curb and or frame work		
Fan installed per Local and State Codes from Outside Air Intakes		
Backdraft Damper Installed and free from Electrical Flex and Screws		
Sheaves properly installed and secured		
Sheaves are properly Aligned		
Bearings are greased		
Fan has sealed bearings		
Fan rotates freely		
Duct Connection has Flexible connection and or Canvas		
Fan installed in proper location (Per Plans ID Number)		
Fan has overload protection and a means of Disconnect (Overloads if required in Spec)		
Power wiring Complete		
Fan Installed in proper Direction of airflow		
Duct has straight connection to inlet and outlet (3 diameters of fan with staight duct)		
Controls		
DDC Controls Installed (If Required)		
Interlock Wiring Complete		
Interlock Wiring Tested and Verified		
Fire Alarm Interface Complete and Tested		
Exhaust / Supply Fan Comments:		
Approval:		
Date:		
Superintendent Signature:		

AHU Functional Performance Test w/economizer

Project Name

AHU #

Date

Item		Final Measurement	
1	Temp Sensors		
1a	Verify Calibration by comparison to Test Instrument measuring temperature at the same location as the sensor. Tolerance = +/- 0.5°F		
		AVG Probe Sensor Test Inst	
	Discharge Air Temp		
	Return Air Temp		
	Mixed Air Temp		
	Return Humidity		
1b	Set up trend log to record DAT, RAT, MAT, and OAT every minute for 15 minutes or until temperature stabilizes		
1c	Take unit out of economizer and verify chiller is running. Then change DAT setpoint to 2° F below MAT. Verify that DAT is controlled within 0.5° F of setpoint within 15 minutes	Time to stabilize minutes	
2	Chill Water Valve		
2a	With chw pumps controlling to Dif Press setpoint, manually command cw valve closed and measure EAT and LAT across cooling coil to verify valve is closed	EAT LAT	
2b	Command valve to 5% open and verify stem starts to open valve. If valve does not move at 5%, increase in 2% increments until valve starts to open. Record % command when valve opens.	% at open	
2c	Manually command valve to 90% open and observe travel of valve		
2d	Manually command valve to 100% open and verify that there is valve stem movement between 90% and 100% position. Verify that the valve is actually 100% open (actuator indicator, visible stem length, etc.		
3	Mixed Air Temp Sensor (Perform only if OAT>35°F)		
3a	Command Unit to 100% OA (or 100% return) and verify calibration by manually closing chill water valve and comparing MAT with DAT sensor readings. DAT minus MAT should be ≤ 3°F	DAT MAT DIFF	
4	Software Low Limit Control 1st Stage		
4a	With unit in economizer mode, set OA dampers at > 50% open Then set software low limit control setpoint to 5° F above actual MAT. Confirm that the OA damper moves toward closed position		
4b	Verify that the setpoint is returned to 6°F below DAT setpoint		

5	Automatic Low Limit 2nd Stage	
5a	With unit in economizer mode, set OA dampers at > 50% open Then set the 2nd stage low limit setpoint to 5°F above the actual MAT and verify that 1.) Chill water valve opens 2.) Sec CW pump energizes 3.) Low temp alarm is initiated. 4.) Max OA damper closes 5.) Relief Damper closes 6.) Return Damper opens.	
5b	Verify that setpoint is returned to DAT setpoint minus 10°F	
6	Manual Reset Freeze Stat/Low Temp Detection	
6a	Verify Setpoint = 34°F	
6b	Use an ice bag to activate freeze stat. Verify via BAS and visual inspection that 1.) SF, RF, & EF's shutdown 2.) Low temp alarm is initiated 3.) Max OA, Min OA & Relief dampers close 4.) Return damper opens 5.) Chill water valve opens 6.) Sec CW pump is energized	
7	SF and RF Airflow Measuring Device Calibration Verification	
7a	Verify calculations and measurements used in cfm calibration routine. Manually control SF to a fixed position 95% of design return cfm. Control RF to maintain 0" SP in MA plenum with relief and all OA dampers closed. Verify that actual Supply and return cfm are within 5%	SA RA Diff % Diff
7b	Verify by airflow traverse where possible the CFM values of SA and RA are accurate. Specify method of measurement	Method- Traverse
7c	Command SA and RA fans off and verify via BAS and visual inspection that airflow monitors read 0 cfm +/- 50cfm	SA 0 RA 0
8	Return Fan Volume Control to Maintain OA cfm verification	
8a	With AHU out of economizer, manually open VAV boxes and control supply fan speed to achieve AHU design CFM. Verify via BAS that RF VFD modulates to maintain OA quantity at design setpoint	Design OA SF % spd RF % spd Act OA
8b	Manually control supply fan speed to 70% of AHU design CFM. Verify via BAS that the RF VFD modulates to maintain min OA quantity at design setpoint	Design OA SF % spd RF % spd Act OA
8c	Using normal BAS setpoints, trend SA, RA, & OA quantities at 5 minute intervals for 24 hours. Verify that SA and RA quantities vary but OA remains constant Trend DAT, MAT, CHW valve position, SF % speed, RF % speed Secondary CHW supply temp, OAT, supply duct static pressure, and OAH. Note DAT and static press setpoints.	

9	Humidifier							
9a	Verify calibration of Supply Duct Humidity Sensor							
9b	Verify calibration of Return Duct Humidity Sensor							
9c	Adjust humidifier lockout setpoint to 5°F > actual OA temperature and verify via BAS that the humidifier is locked out and the steam valve closes							
9d	Return humidifier lockout setpoint to original value							
10	Damper Binding Test							
10a	<p>Command Maximum OA damper closed. Verify Maximum OA damper and Relief Air damper close tightly and the return air damper is fully open. Then send 5% open signal to OA damper and verify that the actuator and the drive blades of the OA and relief dampers begin to move. If any damper does not move, increase signal in 2% increments until the dampers start to move. Record % command that each damper starts to move. If the linked dampers have not moved at a command 5% above the initial movement of the driven blade, check to see if the actuator is connected to the drive end of the drive blade.</p> <p>Actual Damper Movement Begins at</p> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td></td> <td>OA</td> </tr> <tr> <td></td> <td>RA</td> </tr> <tr> <td></td> <td>Relief</td> </tr> </table>		OA		RA		Relief	
	OA							
	RA							
	Relief							
10b	Command Dampers to the 50% position and visually confirm that each damper is approximately 50% open. Wait 5 minutes and record OA CFM setpoint and Actual OA CFM	OA Setpnt Actual OA						
10c	Command dampers to the 90% position and visually confirm that each damper is approximately 90% open. Wait 5 minutes and record OA CFM setpoint and Actual OA CFM	OA Setpnt Actual OA						
10d	Command dampers to 100% open and visually confirm that each damper has movement between 90% and 100% signal. Wait 5 minutes and record min OA CFM setpoint, Actual OA CFM, SF % speed and RF % speed	OA Setpnt Actual OA SF % spd RF % spd						
11	Economizer Mode Operation (Summer Test Method)							
11a	With AHU not operating in economizer mode, wrap global Enthalpy Sensor with an ice pack, verify via BAS and visual inspection that 1.) System switches to economizer mode (Chill water valve closes until dampers modulate to >95%) 2.) Max OA relief, and return dampers modulate to maintain DAT setpoint (adjust as necessary to observe modulation. Remove towel and observe that unit switches out of economizer.							

12	Economizer Mode Operation (Winter Season Test Method)																									
12a	With AHU operating in economizer mode, wrap global enthalpy Sensor with an hot wet towel, verify via BAS and visual inspection that 1.) System switches to mechanical cooling (Chill water valve opens and secondary pump is energized) 2.) Max OA and relief dampers close 3.) Return damper opens 4.) Minimum OA damper stays open.																									
13	Backup Means of switching out of economizer																									
13a	Adjust OAT to 65°F and verify via BAS and visual inspection that 1.) System switches to mechanical cooling (chill water valve opens and secondary pump is energized) 2.) Max OA and relief dampers close 3.) Return damper opens 4.) Min OA damper stays open																									
14	Static Pressure Controller																									
14a	Record location of Sensor Corridor _____ Space _____																									
14b	Verify calibration and that the static reference point is taken from space served																									
14c	Setpoint necessary to satisfy worse case air terminal = 1.5" w.c.																									
14d	Adjust setpoint in increments of .5", up 1" above and 1" below setpoint, verify via BAS and visual inspection that SF modulates to new setpoint. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>"wc</th> <th>SF CFM</th> <th>SF % spd</th> </tr> </thead> <tbody> <tr> <td>1st setpnt</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2nd setpnt</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3rd setpnt</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4th setpnt</td> <td></td> <td></td> <td></td> </tr> <tr> <td>5th setpnt</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		"wc	SF CFM	SF % spd	1st setpnt				2nd setpnt				3rd setpnt				4th setpnt				5th setpnt				
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1st setpnt																										
2nd setpnt																										
3rd setpnt																										
4th setpnt																										
5th setpnt																										
15	HI Static Safety Switch (if applicable)																									
15a	Verify Location																									
15b	Verify calibration by comparison to test instrument measuring at the same location.																									
15c	Verify setpoint, set 1" above static pressure in the discharge plenum when all VAV's are in full colling mode																									
15d	Lower static pressure safety setpoint until SF trips on high static, verify via BAS and visual inspection that 1.) SF, RF and associated EF's shutdown 2.) Max, min OA and relief dampers modulate closed 3.) Return damper modulates open 4.) Steam humidifier valve closes and humidity process is disabled.																									
15e	Adjust static pressure safety switch back to setpoint and reset switch verify via BAS and visual inspection that 1.) Min OA damper modulates open 2.) SF, RF and associated EF's start																									

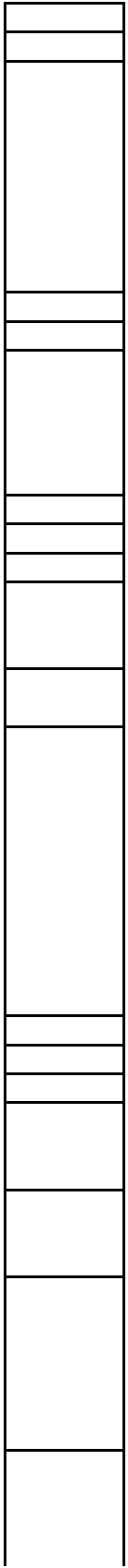
16	Smoke Evac Verification	
16a	Upon receiving signal from smoke detector in OR, verify that 1.) Supply fan VFD goes to 50% 2.) Return Fan VFD goes to 100% 3.) Return damper closes, relief and OA dampers open 100% 4.) Room exhaust Dampers open & low return dampers close	
16b	With unit in OA smoke detection mode, verify that upon detection of smoke at supply or return duct detectors, 1.) supply fan stops 2.) return fan VFD shall go to 100% 3.) OA & return dampers close & relief damper opens 100% 4.) Room exh dprs open & low return dampers close	
17	Fire Alarm Notification	
17a	Upon receiving signal of notification of fire from fire alarm panel, verify via BAS and visual inspection that SF, RF and associated EF's shut down and FS/D close (10 second delay)	
18	Fire Alarm Reset	
18a	Upon receiving signal of reset from from fire alarm panel, verify via BAS and visula inspection that FS/D open (10 second delay) and SF, RF and associated EF's start	
Comments:		

Controls Company _____
 Controls Rep Sig _____
 Printed Name _____ Date _____

Commissioning Co _____
 Comm Rep Signature _____
 Printed Name _____ Date _____

Subcontractor _____
 Sub Rep Signature _____
 Printed Name _____ Date _____

General Contractor _____
 GC Rep Signature _____
 Printed Name _____ Date _____



Pri/Sec CHW Functional Performance Test Report

Pre-test Setpoints / Conditions

Parameter	Pre-test Value
CHW Sys DP set point	
1st Lag Chlr On prg gpm	
1st Lag Chlr Off prg gpm	
CT Basin set point	
2nd Lag Chr On prg gpm	
2nd Lag Chr Off prg gpm	
CW set point	
All CHLR Lv CHW set points	

Parameter	Pre-test Value
Act CHW Sys DP	
Act Sec Pmp #1 Speed	
Act Sec Pmp #2 Speed	
Act Sec Chw gpm	
Lead Chlr (Chlr #)	
1st Lag Chlr(Chlr #)	
2nd Lag Chlr(Chlr#)	

Condition	Test Procedure	Expected Response	Pass:	Note #
			Y/N	
Chlrs Off	Reverse User defined CHLR lead/lag order in BAS	BAS displays new CHLR lead/lag order. Record order of seq. __, __, __.		
Chlrs Off	Manually command AHU's to economizer mode and insure no damper position exceeds 90%.	AHU's operating in economizer mode with no free cooling damper position exceeding 90% .		
AHUs in Econ, Chlrs Off	Enable Lead Chiller: Input OAT 2 F > than Chiller Disable Set Point.	Record Chiller Disable Set Point ____ F. Verify in the BAS that the lead chiller is enabled. Lead Chiller Enabled. Yes ___ No ___		
AHUs in Econ, Chlrs Off	Manually command a single AHU out of economizer mode.	Verify by visual observation that chiller controller starts : Lead Chlr Primary CHW Pump, CW Pump, Lead Sec Chw Pump, Tower Fan Ctl and Lead Chiller Lead Chiller and auxiliaries start. Yes ___ No ___		
One Chlr On	Command all AHU's back to economizer. Input OAT value 1 F lower than value that disables chiller operation.	Verify that Chiller stops. Lead Chiller stops. Yes ___ No ___		
AHUs in Econ, Chlrs Off	After lead chiller recycle timer times out, input OAT 2 F > than Chiller Disable Set Point, command a single AHU free cooling dampers to 100%, and manually set the DAT set point until the DAT is 2 F > than set point.	Verify by visual observation that chiller controller starts : Lead Chlr Primary CHW Pump, CW Pump, Lead Sec Chw Pump, Tower Fan Ctl and Lead Chiller Lead Chiller and auxiliaries start. Yes ___ No ___		
One Chlr On	Demonstrate 1st Lag Chlr start timer: Disable economizer operation. Take manual control of Sec CHW Pumps, Open all AHU CHW control valves. Adjust lead Sec CHW Pump speed to 105% of gpm value in program to start lag chiller. Maintain this flow for 1/2 of time delay value in program and then adjust Sec CHW flow to 90% of this value.	Verify start delay timer has timed out and BAS has not initiated 1st lag Chlr start. 1st Lag Chlr did not receive start signal when timer timed out: Yes ___ No ___		
One Chlr On	Demonstrate Lead Chlr start: Take manual control of Sec CHW Pumps, with all AHU CHW cntrl valves 100% open. Increase lead Sec CHW Pump speed to 105 % of BAS programmed value that starts 1st lag Chlr. Maintain this value until delay timer times out.	Verify 1st lag Chlr start sequence is initiated when the delay timer times out: At BAS auto chiller start delay timer activation, record: Sec CHW flow _____ gpm, Program statement gpm _____. Primary CHW Supply Temp. _____F, Decoupler Line Temp. _____F, Time delay _____min. 1st Lag Chlr start command sent: Yes ___ No ___		
Two Chlrs On	By manual control of Sec CHW Pumps slowly increase the Sec CHWS flow to 105% of BAS programmed value that starts 2nd lag chiller. Maintain this value until delay timer times out.	Verify 2nd lag Chlr initiates start sequence when the delay timer times out: At BAS auto chiller start delay timer activation record: Sec CHW flow _____ gpm, Program statement gpm _____, Primary CHW Sup Temp. _____F, Decoupler Line Temp. _____F, Time delay _____min. 2nd lag Chlr start command sent: Yes ___ No ___		
Three Chlrs On	By manual control of Sec CHW Pumps slowly increase the Sec CHWS flow to 105% of BAS programmed value that starts 3rd lag chiller. Maintain this value until delay timer times out.	Verify 3rd lag Chlr initiates start sequence when the delay timer times out: At BAS auto chiller start delay timer activation record: Sec CHW flow _____ gpm, Program statement gpm _____, Primary CHW Sup Temp. _____F, Decoupler Line Temp. _____F, Time delay _____min. 3rd lag Chlr start command sent: Yes ___ No ___		

Pri/Sec CHW Functional Performance Test Report

Condition	Test Procedure	Expected Response	Pass: Y/N	Note #																																																																																																														
Four Chlrs On	(It is desirable, but it may be impossible, in this step to create sufficient load to keep all chillers on line. Locking out the economizers and the use of preheat may be used. Conduct this step even if only two chillers can be kept on line.) With all AHU CHW control valves 100% open, all chillers running or enabled to run, allow BAS to control Sec CHW pumps to maintain Sec Loop DP at set point established by T&B. Check chlrs evap and condenser flow vs. design, check Sec Loop Flow meter reading against actual total CHW flow through all cooling coils. (Use Decoupler Line Temp and Sec CHW Supply Temp to verify no reverse decoupler flow.)	<p>Record the following values: Time for Sec DP cntrl to stabilize ___ min., T&B Sec DP set point ___ psi, Actual Sec Loop DP ___ psi</p> <table border="0"> <tr> <td></td> <td>Design</td> <td>Actual</td> <td>Design</td> <td>Actual</td> </tr> <tr> <td>C1 Evap DP</td> <td>___ ft</td> <td>___ ft</td> <td>Condenser DP</td> <td>___ ft ___ ft</td> </tr> <tr> <td>Evap Flow</td> <td>___ gpm</td> <td>___ gpm</td> <td>Cond Flow</td> <td>___ gpm ___ gpm</td> </tr> <tr> <td>Evap Tmp in</td> <td>___ F</td> <td>___ F</td> <td>Evap Tmp out</td> <td>___ F ___ F</td> </tr> <tr> <td>Cond Tmp in</td> <td>___ F</td> <td>___ F</td> <td>Cond Tmp out</td> <td>___ F ___ F</td> </tr> <tr> <td>C2 Evap DP</td> <td>___ ft</td> <td>___ ft</td> <td>Condenser DP</td> <td>___ ft ___ ft</td> </tr> <tr> <td>Evap Flow</td> <td>___ gpm</td> <td>___ gpm</td> <td>Cond Flow</td> <td>___ gpm ___ gpm</td> </tr> <tr> <td>Evap Tmp in</td> <td>___ F</td> <td>___ F</td> <td>Evap Tmp out</td> <td>___ F ___ F</td> </tr> <tr> <td>Cond Tmp in</td> <td>___ F</td> <td>___ F</td> <td>Cond Tmp out</td> <td>___ F ___ F</td> </tr> <tr> <td>C3 Evap DP</td> <td>___ ft</td> <td>___ ft</td> <td>Condenser DP</td> <td>___ ft ___ ft</td> </tr> <tr> <td>Evap Flow</td> <td>___ gpm</td> <td>___ gpm</td> <td>Cond Flow</td> <td>___ gpm ___ gpm</td> </tr> <tr> <td>Evap Tmp in</td> <td>___ F</td> <td>___ F</td> <td>Evap Tmp out</td> <td>___ F ___ F</td> </tr> <tr> <td>Cond Tmp in</td> <td>___ F</td> <td>___ F</td> <td>Cond Tmp out</td> <td>___ F ___ F</td> </tr> <tr> <td>C4 Evap DP</td> <td>___ ft</td> <td>___ ft</td> <td>Condenser DP</td> <td>___ ft ___ ft</td> </tr> <tr> <td>Evap Flow</td> <td>___ gpm</td> <td>___ gpm</td> <td>Cond Flow</td> <td>___ gpm ___ gpm</td> </tr> <tr> <td>Evap Tmp in</td> <td>___ F</td> <td>___ F</td> <td>Evap Tmp out</td> <td>___ F ___ F</td> </tr> <tr> <td>Cond Tmp in</td> <td>___ F</td> <td>___ F</td> <td>Cond Tmp out</td> <td>___ F ___ F</td> </tr> <tr> <td>Sec Flow</td> <td>___ gpm ___ gpm</td> <td>Tot Pri Flow</td> <td>___ gpm ___ gpm</td> <td></td> </tr> <tr> <td>AHUs</td> <td>___ gpm ___ gpm</td> <td>Tot Cond Flow</td> <td>___ gpm ___ gpm</td> <td></td> </tr> <tr> <td>Decoupler Line Temp</td> <td>___ F</td> <td>Sec Loop Sup Temp</td> <td>___ F</td> <td></td> </tr> <tr> <td>Sec Loop Ret Tmp</td> <td>___ F</td> <td>PriCHWLoopSupTm</td> <td>___ F</td> <td></td> </tr> <tr> <td>PriCHWLoopRetTm</td> <td>___ F</td> <td></td> <td></td> <td></td> </tr> </table>		Design	Actual	Design	Actual	C1 Evap DP	___ ft	___ ft	Condenser DP	___ ft ___ ft	Evap Flow	___ gpm	___ gpm	Cond Flow	___ gpm ___ gpm	Evap Tmp in	___ F	___ F	Evap Tmp out	___ F ___ F	Cond Tmp in	___ F	___ F	Cond Tmp out	___ F ___ F	C2 Evap DP	___ ft	___ ft	Condenser DP	___ ft ___ ft	Evap Flow	___ gpm	___ gpm	Cond Flow	___ gpm ___ gpm	Evap Tmp in	___ F	___ F	Evap Tmp out	___ F ___ F	Cond Tmp in	___ F	___ F	Cond Tmp out	___ F ___ F	C3 Evap DP	___ ft	___ ft	Condenser DP	___ ft ___ ft	Evap Flow	___ gpm	___ gpm	Cond Flow	___ gpm ___ gpm	Evap Tmp in	___ F	___ F	Evap Tmp out	___ F ___ F	Cond Tmp in	___ F	___ F	Cond Tmp out	___ F ___ F	C4 Evap DP	___ ft	___ ft	Condenser DP	___ ft ___ ft	Evap Flow	___ gpm	___ gpm	Cond Flow	___ gpm ___ gpm	Evap Tmp in	___ F	___ F	Evap Tmp out	___ F ___ F	Cond Tmp in	___ F	___ F	Cond Tmp out	___ F ___ F	Sec Flow	___ gpm ___ gpm	Tot Pri Flow	___ gpm ___ gpm		AHUs	___ gpm ___ gpm	Tot Cond Flow	___ gpm ___ gpm		Decoupler Line Temp	___ F	Sec Loop Sup Temp	___ F		Sec Loop Ret Tmp	___ F	PriCHWLoopSupTm	___ F		PriCHWLoopRetTm	___ F					1
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Four Chlrs On	Above continued, check pass/fail.	Individual Chlrs Evap & Cond Actual Flow = design gpm, plus or minus 5%; Measured Sec Flow (Meter) gpm = Tot AHU Coil Flow plus or minus 10%: Yes ___ No ___		1																																																																																																														
Four Chlrs On	Reverse the Chlr lead/lag user defined sequence in the BAS	Verify that no chillers stop.																																																																																																																
Four Chlrs On	Reset User defined lead/lag sequence to reflect how the chlrs were staged on. With all AHU CHW control valves 100% open, four chillers running or enabled to run, take manual control of the Sec CHW pumps speed. Adjust pump speed downward to 95% of the program statement value used to drop 3rd lag chiller. Maintain this value as the delay timer times out.	Verify 3rd lag Chlr disabled when the delay timer times out: At BAS auto chiller disable delay timer activation, record: Sec CHW flow ___ gpm, Program statement gpm ____, Decoupler Line Temp. ___ F, Time delay ___ min. 3rd lag Chlr disabled: Yes ___ No ___																																																																																																																
Three Chlrs On	With all AHU CHW valves 100% open, two chillers running or enabled to run, take manual control of the Sec CHW pumps speed. Adjust pump speed downward to 95% of the program statement value used to drop 2nd lag chiller. Maintain this value as the delay timer times out.	Verify 2nd lag Chlr disabled when the delay timer times out: At BAS auto chiller disable delay timer activation, record: Sec CHW flow ___ gpm, Program statement gpm ____, Decoupler Line Temp. ____, Time delay ____. 2nd lag Chlr disabled: Yes ___ No ___																																																																																																																
Two Chlrs On	With all AHU CHW valves 100% open, two chillers running or enabled to run, take manual control of the Sec CHW pumps speed. Adjust pump speed downward to 95% of the program statement value used to drop 1st lag chiller. Maintain this value as the delay timer times out.	Verify 1st lag Chlr disabled when the delay timer times out: At BAS auto chiller disable delay timer activation, record: Sec CHW flow ___ gpm, Program statement gpm ____, Decoupler Line Temp. ____, Time delay ____. 1st lag Chlr disabled: Yes ___ No ___																																																																																																																

Pri/Sec CHW Functional Performance Test Report

<p>One Chlr On</p>	<p>Lift signal wire from Sec Loop Flow Meter. Control AHU CHW valves and Sec Pump speeds to obtain a stable Sec CHW Loop Flow 70-80% less than the design value for the chiller in operation. After the Pri CHW Loop Supply Temp has stabilized for 5 min, slowly adjust the AHU CHW control valves and Sec Pump speeds until the Decoupler Line Temp indicates reverse flow.</p>	<p>Verify that the 1st lag Chlr start sequence delay timer is activated when the Decoupler Line Temp minus the Pri CHW Loop Supply Temp reaches the value contained in the program. Verify a start signal is sent to the 1st lag chiller when the timer times out. Record temp difference in program that activates timer _____F and time delay _____ min. At activation: Decoupler Line Temp _____F Pri Chw Loop Supply Temp _____F. 1st lag Chlr received start signal, BAS alarmed, and issued a statement, "Reverse flow in the primary loop. A lag chiller has been started using a backup method.": Yes___ No___</p>		
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Pri/Sec CHW Functional Performance Test Report

Condition	Test Procedure	Expected Response	Pass: Y/N	Note #
Two Chlrs On	With signal wire from Sec Loop Flow Meter still lifted, return the Sec CHW pumps to automatic control, and slowly control the AHU CHW control valves to obtain a Delta T between the Pri CHW Loop Supply Temp and Pri CHW Loop Return Temp that is 40% or less than the design Delta T of the Chlrs' evaporators.	Verify that the BAS drops the Lag chiller when the difference between the Primary CHW Loop Supply Temp and the Pri CHW Loop Return Temp is less than 40% of the design Delta T of the Chlrs' evaporators for the time delay period in the program. Record temperature difference in program that activates timer ____F, the time delay ____min, and the Evap Design Delta T ____F. Record CHW Loop Supply Temp ____F and CHW Loop Return Temp ____ at timer activation. 1st lag Chlr sent stop signal, BAS alarmed, and issued a statement: "A lag chiller has been dropped using a backup method." Yes ___ No ___.		
One Sec Pump on	(This step assumes that parallel Sec CHW Pump operation is a design feature.) Reconnect Sec Loop Flow Meter signal wire. With Sec CHW pumps in automatic control, slowly control AHU CHW valves to increase flow beyond the capacity of a single pump.	Verify Sec CHW lag pump stages on. Record value in program set to bring on lag Sec CHW pump ____ % spd. Record speed of lead Sec CHW pump ____% spd. when lag pump started. Record secondary loop flow, Delta p, and speed of both pumps after flow stabilization: Sch CHW pump #1 _____%spd, Sch CHW pump #2 _____%spd., Sec CHW Flow _____gpm, Act Delta P _____psi., Delta P Set Point _____psi. Lag Sec CHW pump stages on at proper value and then both pumps operate at the same speed to control to static set point. Yes ___ No ___		
Two Sec Pumps On	Slowly control AHU CHW valves to stabilize Sec CHW flow below the capacity of a single pump.	Verify Sec CHW lag pump stages off. Record value in program set to drop lag Sec CHW pump ____ % spd. Record speed of lead Sec CHW pump ____% spd. when lag pump dropped. Record secondary loop flow, Delta p, and speed of lead pump after flow stabilization: Sch CHW pump _____%spd, Sec CHW Flow _____gpm, Act Delta P _____psi., Delta P Set Point _____psi. Lag Sec CHW pump stages off at proper value and lead pump operates to control to static set point. Yes ___ No ___		
One Sec Pump On	At VFD control panel stop Lead Sec CHW pump.	Verify another Sec CHW pump is started by the BAS. Lag or standby Sec CHW pump starts and controls to Delta P Set Point: Yes ___ No ___		
One or more Chlrs On	With Sec CHW pumps and AHU control valves in automatic, manually stop the lead chiller at the chiller control panel.	Verify that the next chiller in sequence automatically starts. Standby chiller starts and BAS alarms the lead chiller. Yes ___ No ___.		

When all the various test modes have been included in the Functional Performance Test Report, return the Pri/Sec CHW System to the appropriate set points and record the value in the Post-Test Setpoint table below:

Pri/Sec CHW Functional Performance Test Report

Post-Test Setpoints

Parameter	Pre-test Value	
CHW Sys DP set point		
1st Lag Chlr On prg gpm		
1st Lag Chlr Off prg gpm		
CT Basin set point		
2nd Lag Chr On prg gpm		
2nd Lag Chr Off prg gpm		
CW set point		
All CHLR Lv CHW set points		

Parameter	Pre-test Value
Act CHW Sys DP	
Act Sec Pmp #1 Speed	
Act Sec Pmp #2 Speed	
Act Sec Chw gpm	
Lead Chlr (Chlr #)	
1st Lag Chlr(Chlr #)	
2nd Lag Chlr(Chlr#)	

Notes:

1. Separately list and attach for each coil taken during this step: Coil Temp/ Press inlet and outlet values and flow in gpm.

2. _____
3. _____
4. _____

Certification that the above testing has been successfully completed:

Print Name

Signature/Date
General Contractor

Print Name

Signature/Date
Mechanical Subcontractor

Print Name

Signature/Date
Controls Subcontractor

**HVAC SYSTEMS COMMISSIONING
FUNCTIONAL PERFORMANCE TEST
VAV BOX**

PROJECT:

SYSTEM:

AHU-

VAV WITH REHEAT COIL			
TEMPERATURE SETPOINTS		YES	NO
Occupied heating set point is 71° Occupied cooling set point is 74°			
Unoccupied heating set point is 60° Unoccupied cooling set point is 85°			
TEMPERATURE SENSORS Verify proper calibration of sensors.			
SENSOR		MEASURED	DDC VALUE
ROOM SENSOR			
OCCUPIED MODE			
Verify the VAV terminal airflow response to room temperature set point. Simulate room temperature 5°F above cooling set point and measure maximum airflow. Simulate room temperature 5°F below heating set point and measure minimum airflow.			
AIRFLOW	DESIGN	MEASURED	DDC VALUE
MAXIMUM FLOW			
MINIMUM FLOW			
Verify the VAV terminal reheat coil response to room temperature set point. Simulate room temperature 5°F above cooling set point and cooling set measure supply temperature. Simulate room temperature 5°F below heating set point and measure supply temperature.			
SETTING		5° ABOVE	5° BELOW
AHU/RTU DISCHARGE AIR TEMPERATURE			
VAV DISCHARGE TEMPERATURE			
EXPECTED DISCHARGE TEMPERATURE			
UNOCCUPIED MODE		YES	NO
VAV controls the same as occupied with the unoccupied temperature set points			
Certification			
We / I have witnessed the above functional performance tests			
Commissioning agent			

SECTION 23-0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

- A. The work covered under this section consists of furnishing all necessary labor, supervision, materials, and equipment required to completely execute the pipe hanger and supports as described in this section.

1.2 REFERENCES

- A. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- B. ASTM A 123 – Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
- C. ASTM A 653 – Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.
- D. ASTM A 1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.
- E. MSS SP-58 – Manufacturers Standardization Society: Pipe Hangers and Supports – Materials, Design, and Manufacture.
- F. MSS SP-69 – Manufacturers Standardization Society: Pipe Hangers and Supports – Selection and Application

1.3 QUALITY ASSURANCE

- A. Steel pipe hangers and supports shall have the manufacturer's name, part number, and applicable size stamped in the part itself for identification.
- B. Hangers and supports shall be designed and manufactured in conformance with MSS SP-58.

1.4 SUBMITTALS

- A. Submit product data on all hanger and support devices, including shields and attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

HANGERS & SUPPORTS FOR HVAC 23-0529-2
Replacement Facility for Wrangell Medical Center – 10528.00
Enfinity Engineering

A. Cooper B-Line, Inc., Anvil International, Inc., or approved equal.

2.2 PIPE HANGERS AND SUPPORTS

A. Hangers:

1. Un-insulated steel pipes ½" to 24" with NO LONGITUDINAL MOVEMENT:
 - a. Adjustable steel clevis hanger equal to B-Line B3100.
2. Un-insulated copper tubing and PVC pipe ½" O.D. to 4" O.D. with NO LONGITUDINAL MOVEMENT:
 - a. Plastic coated adjustable tubing ring hanger equal to B-Line B3170CTC.
3. Un-insulated cast iron soil pipe ¾" to 8":
 - a. Adjustable swivel, split ring type equal to B-Line B3171.
4. Un-insulated cast iron soil pipe 10" to 15":
 - a. Adjustable swivel, split ring type equal to B-Line B3100.
5. Insulated steel piping ½" to 24", galvanized steel piping ½" to 24", copper piping ½" O.D. to 4" O.D., and PVC pipe with NO LONGITUDINAL MOVEMENT:
 - a. Adjustable clevis hanger equal to B-Line B3100.
 - b. Galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation equal to B-Line B3151.

B. Pipe Clamps:

1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3142 with B3200 or approved equal. For insulated lines, use double bolted pipe clamps equal to B-Line B3144 or B3146 with B3200.

C. Multiple or trapeze hangers

1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS Gr. 33 structural steel channel, 1-5/8" x 1-5/8" minimum equal to B-Line B22 strut or stronger as required.
2. Mount pipes to trapeze with two piece pipe straps sized for outside diameter of pipe equal to B-Line B2000 series.
3. For pipes subject to axial movement:
 - a. Strut mounted roller support equal to B-Line B3126. Use pipe protection shield or saddles on insulated lines.
 - b. Strut mounted pipe guide equal to B-Line B2417.

D. Wall Supports

1. Pipes 4" and smaller:
 - a. Carbon steel hook equal to B-Line B3191.
 - b. Carbon steel J-hanger equal to B-Line 3690.
2. Pipes larger than 4":

HANGERS & SUPPORTS FOR HVAC 23-0529-3
Replacement Facility for Wrangell Medical Center – 10528.00
Enfinity Engineering

- a. Welded strut bracket and pipe straps equal to B-Line B3064 and B2000 series.
- b. Welded steel brackets equal to B-Line B3066 or B3067, with roller chair or adjustable steel yoke pipe roll equal to B-Line B3120 or B3110. Use pipe protection shield or saddles on insulated lines.

E. Floor Supports

1. Piping with NO LONGITUDINAL MOVEMENT and piping under 6" WITH LONGITUDINAL MOVEMENT:
 - a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation equal to B-Line B3093 and B3088T or B3090 and B3088. Pipe saddle shall be screwed or welded to appropriate base stand.

F. Vertical Supports

1. Steel riser clamp sized to fit outside diameter of pipe equal to B-Line B3373 or B3374.

2.3 UPPER ATTACHMENTS

A. Beam Clamps

1. Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.
2. C-Clamps shall have locknuts and cup point set screws equal to B-Line B351L or B3036L. Top flange C-clamps shall be used when attaching a hanger rod to the top flange of structural shapes and shall be equal to B-Line B3034 or B3033. Refer to manufacturers' recommendation for setscrew torque. Retaining straps shall be used to maintain the clamp's position on the beam where required. Retaining straps are REQUIRED for all seismically braced items.
3. Center loaded beam clamps shall be used where specified. Steel clamps shall be B-Line B3050 or B3055. Malleable iron or forged steel beam clamps with cross bolt shall be equal to B-Line B3054 or B3291 – B3297 series as required to fit beams.

B. Concrete Inserts

1. Cast in place spot concrete inserts shall be used where applicable, either steel or malleable iron body equal to B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select insert nuts to suit threaded hanger and rod sizes equal to B-Line N2500 or B3014N series.
2. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A 1011 SS Grade 33 structural quality carbon

HANGERS & SUPPORTS FOR HVAC 23-0529-4
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steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete inserts shall have a load rating of 2,000 lbs/ft in concrete and shall be equal to B-Line B221, B321, or B521 (B521 is limited to 1,500 lbs/ft). Select channel nuts suitable for strut and rod sizes.

2.4 ACCESSORIES

- A. Hanger rods shall be threaded on both ends and shall be equal to B-Line B3205. Continuous threaded rods of circular cross section may also be used. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.
- B. Shields shall be 180 degree galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match the outside diameter of the insulated pipe and shall be equal to B-Line B3151.
- C. Pipe protection saddles shall be formed from carbon steel, 1/8" minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12" shall have a center support rib.

2.5 FINISHES

- A. Hangers and strut located indoors and all hanger hardware shall be electro-plated zinc in accordance with ASTM B 633 SC1 or SC3.
- B. Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A 123. All hanger hardware shall be hot dip galvanized or stainless steel.
- C. Hangers and strut located in corrosive areas shall be Type 304 stainless steel with stainless steel hardware.

PART 3 - EXECUTION

3.1 PIPE HANGERS AND SUPPORT

- A. Pipe shall be adequately supported by pipe hanger and supports specified in Part 2 - Products. Hangers for insulated pipes shall be sized to accommodate insulation thickness.
- B. Horizontal steel piping shall be supported in accordance with MSS SP-69, Tables 3 and 4. The following is an excerpt from those tables:

HANGERS & SUPPORTS FOR HVAC 23-0529-5
 Replacement Facility for Wrangell Medical Center – 10528.00
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Nominal Pipe Size	Rod Diameter	Maximum Spacing
3/8" – 1-3/4"	3/8"	7'-0"
1-1/2"	3/8"	9'-0"
2"	3/8"	10'-0"
2-1/2"	1/2"	11'-0"
3"	1/2"	12'-0"
3-1/2"	1/2"	13'-0"
4"	5/8"	14'-0"
5"	5/8"	16'-0"
6"	3/4"	17'-0"
8"	3/4"	19'-0"
10"	7/8"	22'-0"
12"	7/8"	23'-0"
14"	1"	25'-0"
16"	1"	27'-0"

- C. Horizontal copper tubing shall be supported in accordance with MSS SP-69, Tables 3 and 4. The following is an excerpt from those tables:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
1/4" – 3/4"	3/8"	5'-0"
1"	3/8"	6'-0"
1-1/4"	3/8"	7'-0"
1-1/2"	3/8"	8'-0"
2"	3/8"	8'-0"
2-1/2"	1/2"	9'-0"
3"	1/2"	10'-0"
3-1/2"	1/2"	11'-0"
4"	1/2"	12'-0"
5"	1/2"	13'-0"
6"	5/8"	14'-0"
8"	3/4"	16'-0"

- D. Horizontal Schedule 40 PVC piping shall be supported in accordance with the following table:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
1/2"	3/8"	4'-0"
3/4"	3/8"	4'-0"
1"	3/8"	4'-6"
1-1/4" – 2"	3/8"	5'-0"
2-1/2" – 3"	1/2"	6'-0"
4"	1/2"	6'-6"
6"	5/8"	7'-6"
8"	3/4"	8'-0"
10"	3/4"	8'-6"
12"	3/4"	9'-6"

HANGERS & SUPPORTS FOR HVAC 23-0529-6
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- E. Horizontal Schedule 80 PVC piping shall be supported in accordance with the following table:

Nominal Pipe Size	Rod Diameter	Maximum Spacing
½"	3/8"	4'-6"
¾"	3/8"	4'-6"
1"	3/8"	5'-0"
1-1/4" – 1-1/2"	3/8"	5'-6"
2"	1/2"	6'-0"
2-1/2"	1/2"	6'-6"
3"	1/2"	7'-0"
4"	1/2"	7'-6"
6"	5/8"	9'-0"
8"	3/4"	9'-6"
10"	3/4"	10'-0"
12"	3/4"	10'-6"

3.2 CONCRETE INSERTS

- A. Provide inserts for placement in formwork before concrete is poured.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Where concrete slabs from finished ceilings, provide inserts to be flush with slab surface.
- D. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

3.3 GENERAL

- A. Pipe shall be suspended from the building structure in a neat and workmanlike manner. Wherever possible, parallel runs of horizontal pipe shall be grouped on trapeze type hangers utilizing angle iron or uni-strut. Excess all thread rod shall not exceed 1 ½ "below pipe support.
- B. The use of wire or perforated metal strapping is not permitted.
- C. Hanging of pipe from other pipes, duct, etc is not permitted.
- D. Supports shall be designed and installed such that neither pipe nor supports will be subject to electrolytic action. Provide dielectric isolation between dissimilar metals of piping and supports (tape (electricians, duct, etc. is not acceptable).
- E. Provide anchors as required for proper anchorage including channels, plate etc.
- F. Insulation saddles shall be adhered to the insulation jacket with adhesive.

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- G. Hangers for piping 2 ½” and smaller utilizing teardrop hangers, hanger and pipe shall be insulated as an assembly. Piping 3” and above shall be supported by sections of cellular glass (foam glass) insulation placed in the insulation saddle to protect against damage to the insulation caused by excessive weight. Installation of just a metal pipe saddle is not sufficient.
- H. For the installation of steam and steam condensate piping, use welded on insulation saddles and roller hangers. Heating hot water systems shall be evaluated on a case by case basis dependant on the length of piping and expansion expected.
- I. Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents. Cast-iron soil pipe shall be supported at not less than every story height and at its base. Screwed pipe shall be supported at not less than every other story height. Copper tubing shall be supported at each story for piping 3/4 inch and over and at not more than intervals of four feet for 5/8 inch and smaller.
- J. Piping may be grouped together and supported from galvanized angle iron trapeze hangers. Provide insulation saddles to protect the pipe insulation.

END OF SECTION

SECTION 23-0593
TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This work shall include all HVAC and piping systems. Contractor shall provide all equipment necessary for testing and balancing.
- B. Perform test and balance work by an independent NEBB and/or AABC certified Test and Balance Agency that has experienced and trained personnel with at least 5 years experience in the type of work defined in the project scope.
- C. Perform test and balance in accordance with nationally accepted standards for the practice of testing and balancing of systems per the project documents.
- D. The TAB agency shall review construction plans and specifications. If any discrepancies are noted which would hinder balancing, notify the designer with copy to the contractor. Make inspections of the job during construction for proper installation of the system(s) and of balancing aids in the system(s). Any discrepancies noted shall be brought to the attention of the contractor and designer. The number of inspections may vary with the size and complexity of the job and shall be adequate for the purpose intended.
- E. Coordination with the agency at the job site shall be the responsibility of the contractor in order to ensure proper scheduling and operation of the systems. All correspondence (reports, letters and communications) between any parties shall have copies sent directly to the contractor.

PART 2 - TESTING AND BALANCING PROCEDURES

2.1 AIRSIDE

- A. Supply Air:
 - 1. Fans checked for rotation, amperage, static pressure, etc.
 - 2. Terminal boxes set to maximum and minimum cfm and supply outlets balanced to within 10% of design cfm.
 - 3. Main supply duct pitot tube traverse shall be used in coordination with adjustments of the fan speed to produce design cfm while maintaining minimum system static pressure for proper terminal box operation.
- B. Return Air:
 - 1. Fans checked for rotation, amperage, static pressure, etc.
 - 2. With supply system in the maximum mode, traverse and adjust return fan to design cfm.
 - 3. With supply system in the maximum mode, proportion return inlets to within 10% of design cfm.

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- C. Outside Air:
 - 1. Fans checked for rotation, amperage, static pressure, etc.
 - 2. With supply system in the maximum mode, traverse and adjust minimum outside air damper and/or fan to design cfm.

- D. Exhaust Air:
 - 1. Fans checked for rotation, amperage, static pressure, etc.
 - 2. With supply system in the maximum mode, traverse and adjust exhaust fan to design cfm.
 - 3. Proportion exhaust inlets to within 10% of design cfm.

- E. Diffusers, Registers, and Grilles:
 - 1. Balance each supply, return and exhaust air outlet within 10% of design cfm.
 - 2. Check and/or adjust pressure relationships so that each positive pressure and each negative pressure area is at least 10% positive or negative as appropriate.

- F. After completion, take total air-handling system static profile and record all final statics, amperages, rpm, cfm, etc.

2.2 WATERSIDE

- A. Chilled Water System
 - 1. Check system for cleanliness.
 - 2. With all chilled water valves calling for full cooling, test, set and record each pump head and flow.
 - 3. Test, set, and record pressure drop and flow through each chiller.
 - 4. Test, set and record pressure drop and flow through each flow balancing station.
 - 5. Test, set and record pressure drop and flow through each cooling coil.
 - 6. Verify that piping system is vented.
 - 7. Verify removal of pump start up strainer and replacement with operating strainer.

- B. Controls
 - 1. AHU Controls
 - (a) Check temperature controls for proper calibration and setpoint.
 - (b) Check economizer controls for proper damper operation and control calibration.
 - (c) Check supply/return volumetric synchronization system under maximum and minimum conditions for proper operation.
 - (d) Check static pressure control under maximum and minimum conditions for proper operation.
 - 2. Chiller Controls
 - (a) Verify chiller controller is set at design chilled water temperature.

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- (b) Verify central chiller control panel properly stages chillers.
- 3. Thermostats and Controllers
 - (a) Check for proper control of valves, dampers, terminal boxes, exhaust fans, etc.
 - (b) Set at design set point.

C. Capacity and Performance Test

- 1. Cooling Coils
 - (a) Test, set and record pressure drop and flow through each coil.
 - (b) Measure entering and leaving dry and wet bulb air temperatures with glass stem, mercury thermometers accurate to 1/2 degrees F.
 - (c) Measure entering and leaving water temperature. If P.T. plugs are provided, use a calibrated thermometer which reads in 0.1 degree F. increments and use the same thermometer for both supply and return water temperature measurements.
 - (d) Record final temperatures and GPM.
 - (e) Convert actual test conditions to design conditions to insure design coil capacities at design temperatures.
- 2. Terminal Box Heating Coils
 - (a) Test, set and record flow through terminal box heating coil.
- 3. Chillers
 - (a) Record full load entering and leaving chilled water temperatures with glass stem, mercury thermometers accurate to 1/2 degree F.
 - (b) Record GPM at time of test.
 - (c) Record amperage and voltage.
 - (d) Perform log-test for a minimum of one hour taking readings at least every ten minutes.
 - (e) Average all readings and compute test capacity in BTU/HR. and in tons.
 - (f) Average all readings and compute actual kw/ton of chiller.
- 4. Thermostat Calibration
 - (a) Measure and record dry and wet bulb temperatures at each thermostat.
 - (b) Report any thermostat that is not controlling with +/-1-1/2 degree F.
- 5. Control Temperature Readouts
 - (a) Test actual temperature next to sensor (if possible) and compare to readout.
 - (b) Report any sensor that is not within +/-1-1-2 degrees F.

2.3 GENERAL REQUIREMENTS

- A. After completion of the installation of the air conditioning, heating, ventilating and exhaust systems, and prior to acceptance by the Owners, all air handling systems and appurtenances applicable to the above system shall be adjusted and balanced

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to deliver the air quantities as specified, indicated on the drawings, or as directed.
Air balancing shall be done with all doors closed.

- B. Instruments required for the air balance shall have been calibrated within a period of one year prior to balancing. Types and dates of calibration of all instruments shall be listed in the final air balance reports hereinafter specified. Duct systems shall be leak tested in accordance with SMACNA Standards. Leakage rate shall not exceed maximum levels as specified in the standards.
- C. Air quantity measurements in main and branch ducts shall be performed by pitot tube traverse of the entire cross-sectional area of the duct. Ducts having velocities of 1000 or more feet per minute shall be measured by inclined manometers (draft gauge) or magnehelic gauges. Air measurements required for ducts having velocities of less than 1000 feet per minute shall be performed with micro-manometers, hood gauges or similar low-pressure instruments. Openings in ducts for pitot tube insertion shall be sealed with snap-in plugs after air balance is complete. Outlet and inlet air quantities shall be determined by direct reading velocity meters in accordance with outlet and inlet manufacturer's recommendations.
- D. Total air quantities shall be obtained by adjustment of fan speeds. Branch duct air quantities shall be adjusted by volume or splitter dampers. Dampers shall be permanently marked after air balance is complete so that they can be restored to their correct position if disturbed at any time.
- E. Volume adjusters may be used to balance air quantities at outlets and inlets providing final adjustments do not produce sound levels in excess of heretofore specified limits, or objectionable drafts. Air quantity adjustments by outlet deflectors, grids or air scoops will not be permitted.
- F. Record and submit for evaluation and approval three (3) copies of the complete air balance report. Replacement of adjustable pulleys, addition of balancing dampers or pressure taps, required to effect proper air balance shall be furnished and installed by the Contractor at no additional cost to the Owner. If requested, any or all of the above field tests shall be conducted in the presence of the Architect's representative.
- G. In addition, the contractor shall submit to the Architect a typed, written report to include the following:
 - 1. A statement that all systems have been tested, checked out, balanced and are operating properly.
 - 2. A statement that all filters have been replaced.
- H. All reports by the Contractor shall include both the date of the test and the names of all persons performing and witnessing the tests.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

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- A. All work shall be complete and any openings or insulation disturbance due to the testing process shall be replaced and taped.
- B. If, after balancing to the requirements above, some room temperatures deviate more than 3 degrees F from the thermostatic set point of the respective zone, the contractor shall make minor adjustments in the airflow to minimize temperature deviations at no additional cost to the owner.

END OF SECTION

SECTION 23-0713
DUCT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of duct insulation work as indicated on the drawings and by the requirements of this section.

1.2 QUALITY ASSURANCE

- A. Provide duct insulation products produced by one or more of the following manufacturers for each type of insulation and temperature range required:
1. Armacell LLC.
 2. CertainTeed Corp.
 3. Johns Manville
 4. Knauf Fiberglass
 5. Owens Corning
 6. Pittsburg Corning Corp.
- B. Fire/Smoke Ratings: Provide composite duct insulation (insulation, jackets, covering, sealers, mastics and adhesives) with flame-spread rating and smoke-developed rating as tested by ASTM E84 (NFPA 225) method. Composite rating shall not exceed the values shown with the physical properties for each type of insulation in this section.

PART 2 - PRODUCTS

2.1 DUCT INSULATION

- A. Board Type Duct Insulation:
1. Provide minimum 3 pound per cubic foot density semi-rigid, factory-reinforced foil faced Kraft vapor barrier glass board "system" type insulation, having a minimum "R" value of 5. Insulation to conform strictly to fire-resistive qualities hereinbefore specified in "Quality Assurance" paragraph.
 - (a) Supply/Return/Outside air double wall ducts, outside air plenums - ducts shall be insulated with 1-1/2" thick, 3 lb./cu.ft. density semi-rigid board type insulation. Joints shall be sealed with glassfab and mastic. Any single wall ducts shall have eternal insulation.
- D. Kitchen Hood Exhaust Duct Fire Rated Insulation

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1. 3M™ Fire Barrier Duct Wrap 15A 2 hour fire resistant wrap. Insulation shall have passed the UL1978 test which simulates a grease duct fire. Provide 3M Fire Barrier 1000 N/S, 1003 S/L and 2000+ Silicone Sealants when the duct penetrates fire rated walls and floors.
 2. Insulation must tested in accordance with the following:
ASTM C 411, ASTM E 119, ASTM C 518, ASTM E 136, ASTM E 84, ASTM E 814, UL 1978 (Sections 12 & 13)
 3. Surface Burning Characteristics (ASTM E 84)
 4. Flame Spread and Smoke Developed: 0,0
- E. All vapor barrier material, including the ASJ jackets and kraft-paper aluminum-foil jackets previously described shall meet the requirements of Federal Specification HN-B-100B, "Barrier Material Vapor (for pipe, duct and equipment thermal insulation) Type 1.
- F. Staples, bands, wires and cements shall be as recommended by the insulation manufacturer for the applications indicated.
- G. Adhesives, sealers, and protective finishes shall be as recommended by the insulation for each application.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Insulate all surfaces as indicated by drawings and specifications. Where more than one type of insulation is indicated for a particular application, selection shall be the contractors option.
- B. Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices.
- C. Surfaces shall be clean and dry prior to application of insulation. The piping system shall be tight with all testing and corrections complete.
- D. Install insulation materials with smooth and even surfaces. Do not use cut pieces or scraps abutting each other.
- E. Extend insulation without interruption through walls, floors and similar penetrations, except where otherwise indicated.
- F. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation between duct and angle support. Insulation shall not be installed over duct supports.

END OF SECTION

SECTION 23-0719
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of piping insulation work as indicated on the drawings and by the requirements of this section.

1.2 QUALITY ASSURANCE

- A. Provide piping insulation products produced by one or more of the following manufacturers for each type of insulation and temperature range required:
1. Armacell LLC.
 2. CertainTeed Corp.
 3. Johns Manville
 4. Knauf Fiberglass
 5. Owens Corning
 6. Pittsburg Corning Corp.
- B. Fire/Smoke Ratings: Provide composite pipe insulation (insulation, jackets, covering, sealers, mastics and adhesives) with flame-spread rating and smoke-developed rating as tested by ASTM E84 (NFPA 225) method. Composite rating shall not exceed the values shown with the physical properties for each type of insulation in this section.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

- A. Flexible Tubular Elastomeric:
1. Provide fire-retardant closed-cell slip-on flexible type. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 220 degrees F and a minimum "R" value of 3.70. Product to be equivalent to Armacell LLC "Armaflex AP". Applicable products manufactured by Manville and Rubatex are acceptable. Provide insulation for the following services:
 - (a) Refrigerant suction and hot gas lines – For pipe sizes up to 1-1/2" – 3/4" thick. For pipe sizes larger than 1-1/2" – 1" thick.
- B. Fiberglass:
1. Provide factory-formed factory-jacketed "system" type conforming strictly to fire-resistive qualities herein before specified in "Quality Assurance" section. Jacket to be vapor-barrier type when used for systems operating

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below 60 degrees F. "System" density shall not less than 4 pounds per cubic foot. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 650 degrees F and a minimum "R" value of 4.00. Product to be equivalent to Manville "Micro-Lok 650" with type AP jacketing. Product to be manufactured by Owens Corning, Manville or Knauf. Jacket to be fiberglass reinforced kraft paper with aluminum foil and self-sealing lap joint.

2. Provide insulation of thickness for following services:

- (a) Chilled water and Condenser water piping: 1" thick for 1-1/2" and smaller pipe, 1-1/2" thick for 2" and larger pipe.

C. Polyisocyanurate

- 1. Provide a polyurethane modified polyisocyanurate cellular plastic pipe insulation equal to Dow Trymer 2000XP.
- 2. The insulation shall require a Flame Spread Index of 25 or less and Smoke Developed Index of 50 or less.
- 3. Provide insulation of the thickness listed for the following services:

- (a) Chilled water piping: 1" thick for piping 1-1/2" and smaller, 1-1/2" thick for piping 2" and larger.
- (b) piping (exterior): 1-1/2" thick for all pipe sizes.

D. Piping located in unconditioned mechanical rooms, attics shall have the thickness listed above increased by 1/2".

E. For any service when above grade exposed-to-the-weather outside building, cover straight pipe insulation with 0.016" thick aluminum jacket equivalent to Childers and cover valves and fittings with .024" thick aluminum factory formed covers equivalent to Childers Ell-Jacs.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Pipe saddles for protection of the insulation shall be provided by the insulation sub-contractor and installed at the time the insulation is applied. Saddles shall be secured to insulation with adhesive.
- B. Insulate all surfaces as indicated by drawings and specifications. Where more than one type of insulation is indicated for a particular application, selection shall be the contractors option.
- C. Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices.

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- D. Surfaces shall be clean and dry prior to application of insulation. The piping system shall be tight with all testing and corrections complete.
- E. Install insulation materials with smooth and even surfaces. Insulate each continuous run of pipe with full-length units of insulation, with a single cut piece to complete each run. Do not use cut pieces or scraps abutting each other.
- F. Cover valves, flanges, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, pre-cut, or job fabricated units (at installers option), except where a specific form or type is indicated. In no case shall insulation cover gauges, plug cock indicators, or other items required for visual reference.
- G. Extend insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation between pipe and hanger. Insulation shall not be installed over pipe hangers.
- I. All pipe insulation exposed to weather, except as otherwise described, shall be finished with .016 inch, (standard thickness) aluminum jacket and pre-formed aluminum fitting covers, by Childers or approved equal.
- J. Fiberglass Insulation on Cold Piping:
 - 1. Insulation on concealed piping shall be finished with white paintable, fire-retardant ASJ jacket.
 - 2. Butt all joints firmly together and smoothly secure all jacket laps and joint strips with lap adhesive. End of pipe insulation shall be sealed off with a vapor barrier coating at all fittings and valves and at each joint of insulation in addition to any other manufacture's recommendations.
 - 3. Insulate fittings and valves with molded fiberglass fittings, segments of pipe insulation, or with firmly compressed foil-faced fiberglass blanket with PVC covers. Secure in place with 20 gauge corrosion-resistant wire and apply a smoothing coat of insulating cement. Vapor seal by applying a layer of open-weave glass cloth fabric embedded between two coats of vapor-barrier mastic. Lap glass fabric 2" onto adjacent pipe. (In lieu of glass cloth embedded between coats of mastic, premolded fitting covers sealed at all edges with vapor barrier adhesive. Secure ends of covers with pressure-sensitive vinyl tape).

END OF SECTION

SECTION 23-0800
MECHANICAL SYSTEM COMMISSIONING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Commissioning: Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment start-up/checkout, control system calibration and point-to-point (PTP) checkout, testing and balancing, verification, field functional performance testing and Owner training.
- B. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.
- C. Abbreviations: The following are common abbreviations used in these Specifications:
 - C/S - Contractor/Subcontractor
 - O/D - Owner/Design Consultant
 - FPT - Functional Performance Verification Test
 - PC - Pre-Functional checklist
 - GC - General contractor (prime)
 - MC - Mechanical contractor
 - Subs - Subcontractors to General
 - TAB - Test and balance

1.2 SYSTEMS TO BE COMMISSIONED

- A. The following systems will be commissioned in this project:
 - 1. HVAC Systems: water cooled chillers, air cooled chiller, cooling towers, boilers, deaerator, convertors, fuel oil pumps, water pumps, condensate return units, air handlers, variable frequency drives, terminal boxes, fan coil units, unit heaters, electric heaters, fans, fire and smoke dampers, steam and condensate piping, Building Automation System (and EMS).

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of plus or minus 0.1 degree F. Pressure sensors shall have an accuracy of plus or minus 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when

dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 PREFUNCTIONAL CHECKLISTS

- A. General: Prefunctional checklists are important to ensure that the equipment and systems are operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The checklist is intentionally designed as a broad, high level check of the completed installation and is not intended to cover all the detailed checks necessary during the installation process or during the vendor startup required for some equipment. The PC for a given system must be successfully completed prior to the beginning of the TAB field work and formal functional performance testing of equipment or subsystems of the given system.
- B. PC forms have been developed and are included in this specification section under subparagraph 3.3, Submittal Forms. The PC should be used to inspect the completed installation of major HVAC equipment. Since the checklist is generic, intended for use on multiple projects, some line items may not apply to this project or certain pieces of equipment. If a PC line item does not apply, indicate this by checking the N/A column rather than the OK column. PC line items that are not complete or are not in compliance at inspection should not be checked as OK until they are completed. The section below each PC shall be utilized for recording comments or making notes. As the work progresses, other forms may be developed as necessary for special pieces of equipment not adequately covered by the included PC forms.
- C. Copy the PC and complete a separate form for each individual piece of equipment where multiple similar or identical pieces of equipment are installed.
- D. The MC representative shall inspect the installed HVAC equipment using the PC and initial and date each item that passes inspection. Only individuals that have direct knowledge and witnesses that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.
- E. The GC shall oversee the subs and the vendors in collecting and retesting deficiencies or uncompleted items. The installing subs or vendors shall correct all areas that are deficient in the checklists and tests in a timely manner, and shall notify the GC as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report.
- F. Items left incomplete, which later cause deficiencies or delays during functional testing, may result in back charges to the responsible party.
- G. When each item on the checklist has passed inspection, the MC and GC shall also inspect the installed equipment and sign the checklist to certify the installation is complete and acceptable from a quality standpoint. The signed checklist is to be included in the project closeout documents delivered to the owner.

3.2 FUNCTIONAL PERFORMANCE TESTING

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- A. Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
- B. Specific FPT forms have been developed and are included in this specification section under subparagraph 3.3, Submittal Forms. Prior to execution, the GC shall provide a copy of the test procedures to the sub(s) who shall review the tests of feasibility, safety, equipment, and warranty protection. As the work progresses, other forms may be developed as necessary for special pieces of equipment not adequately covered by the FPT forms included with this specification section.
- C. C/S FPT: The contractor and subs shall witness and document the results of all FPT using the included procedural forms. Once the C/S FPT has been completed successfully, the contractor shall repeat the FPT in the presence of the O/D. The O/D will decide during the Performance Verification site visit whether all or a representative sample of systems will be subject to this testing.
- D. The contractor is responsible for including the FPT both by C/S and by O/D in the construction schedule. The contractor is responsible for contacting the project architect and scheduling the design consultants and owners representative to witness the FPT. The design consultants and owners representatives reserve the right to terminate the FPT if in their opinion the test results indicate the systems are not progressing properly. The contractor shall be responsible for return travel expenses for any retest. All systems required for owner occupancy will have their FPT completed and approved prior to Owner occupancy, opposed season test excluded.
- E. The contractor shall incorporate in the project closeout documents all the approved C/S FPT and O/D FPT results and procedures.

3.3 SUBMITTAL FORMS

- A. Prefunctional Checklists.
- B. Functional Performance Test Report.
- C. Prior to commissioning, calibrate and document every AHU sensor, chilled water system sensor and hot water system sensor by instrumentation and EMS. Provide a list of every sensor value from the EMS after final calibration vs. reading by the calibration instrument.

END OF SECTION

SECTION 23-0914
VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. Furnish complete variable frequency motor controllers (VSMC) as specified herein for the fans and pumps designated. All standard and optional features shall be included within the VSMC enclosure unless otherwise specified.
- B. Provide VSMCs for the pieces of equipment as designated on the drawings. All VSMCs provided to be of same manufacturer.

1.2 QUALITY ASSURANCE

- A. To ensure quality and minimize infantile failures at the job site, the VSMC shall be burned in at an ambient of 40 degrees Celsius minimum for at least 120 hours. The VSMC shall be operating a dynamometer and the load and speed shall be cycled during the test. All optional and special features shall be functionally tested at the factory for proper operation.

1.3 WARRANTY

- A. The VSMC shall carry the manufacturer's warranty for a period of 36 months from date of start-up. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized on-site service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. VSMC to be manufactured by ABB.
- B. The VSMC shall convert 3-phase, 60-Hz utility power to adjustable voltage and frequency, 3-phase, AC power for stepless motor speed control from 5% to 100% of the motor's Hz speed. Input voltage shall be as indicated on the equipment schedules on drawings.
- C. Converter Section: Full wave diode bridge rectifier.
- D. Inverter Section: Transistorized sine coded pulse width modulated (PWM) type for stepless motor speed control.
- E. Silicon-controlled rectifiers (SCRs) or GTOs shall not be used in the circuitry.
- F. The VSMC maximum output current rating shall be 110 percent of the motor nameplate full load current.

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- G. The VSMC and options shall be tested to ANSI/UL Standard 508. The complete drive including all options shall be listed by a nationally recognized testing agency such as U.L. or ETL.
- H. The VSMC and options shall comply with the applicable requirements of the latest standards of ANSI, IEEE, and the National Electrical Code. The VSMCs full load amp rating shall meet or exceed NEC Table 430-150.
- I. Power line noise shall be limited to a voltage distortion of 3 percent and line notch depth of 10 percent or 16,400 volt microseconds whichever is less as defined in IEEE Standard 519, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. Provide isolation transformer.
- J. The VSMC shall not emit either conducted or radiated RFI in excess of the limitations set forth in the FCC Rules and Regulations, Part 15, Subpart J, for class A computing devices. The VFD shall have an FCC compliance label. Provide RFI filters if required.
- K. The increase in audible motor noise with the VSMC operating shall not exceed 3 decibels.

2.2 BASIC FEATURES: The VSMC shall include the following basic features:

- A. All indoor VSMCs shall be housed in a NEMA 1 enclosure and shall be wall or floor mounted as shown on drawings. All VSMCs located outside shall be housed in a weatherproof NEMA 3R enclosure with heater and ventilation fan.
- B. The following operator controls shall be located on the front of the enclosure:
 - 1. Hand/Off/Auto selector switch to start and stop the motor. In the auto position, the drive will start/stop from a remote contact closure.
 - 2. Auto/Manual selector switch. In the auto position, motor speed is determined by the follower signal. In the manual position, motor speed is determined by the manual speed potentiometer.
 - 3. Manual speed potentiometer.
 - 4. Power on pilot light to indicate that the AFC is being supplied by the power line.
 - 5. Fault pilot light to indicate that the AFC has tripped on a fault condition.
 - 6. Digital meter to indicate percent speed and percent load.
- C. Two sets of form C, dry contacts to indicate when the VSMC is in the run mode.
- D. One set of form C, dry contacts to indicate when the VSMC is in the fault mode.

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- E. When input power returns to normal following a fault trip for under-voltage, over-voltage, or phase loss, the VSMC shall automatically restart. The VSMC shall not automatically restart following fault trips due to overload or over-current.
 - F. The VSMC shall include a door interlocked, padlockable, input power disconnect switch.
 - G. **SPEED CONTROL:** The output frequency may be adjusted in proportion to any one of the following:
 - 1. 0-10 VDC Analog Signal.
 - 2. 0-5 VDC Analog Signal.
 - 3. 4-20 MA DC Analog Signal.
 - H. Coordinate with controls supplier for exact input signal and type to provide proper input follower (i.e., grounded or floating).
- 2.3 **PROTECTIVE FEATURES:** The VSMC shall include the following protective features:
- A. Current limiting semiconductor fuses for the power input.
 - B. Separate overload relay for each motor controlled.
 - C. Protection against input power under-voltage, over-voltage, and phase loss.
 - D. Protection against output current overload and over-current.
 - E. Protection against over-temperature within the VSMC enclosure.
 - F. Protection against over-voltage on the DC bus.
 - G. In the event of a power loss, shutdown without component failure. Upon return of power, automatically return drive to normal operation, if the start is in the "ON" condition, being able to restart into a rotating motor regaining positive speed control without shutdown or component failure.
 - H. In the event of a phase-to-phase short circuit, shutdown safely without component failure.
 - I. In the event that an input or output power contactor is opened or closed while the drive is activated, no damage to the VSMC shall result.
 - J. DC bus discharge circuit for protection of service personnel.
 - K. Insensitive to incoming power phase sequence.
- 2.4 **ADJUSTMENTS:** The VSMC shall include the following adjustments available via potentiometers inside the enclosure:
- A. Maximum speed, adjustable 50-100% base speed.

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- B. Minimum speed, adjustable 0-50% base speed.
 - C. Acceleration time, adjustable 2-60 seconds.
 - D. Deceleration time, adjustable 2-60 seconds with override circuit to prevent nuisance trips if deceleration time is set too short.
 - E. Current limit, adjustable 0-110%.
- 2.5 SERVICE CONDITIONS: The VSMC shall be designed to operate within the following service conditions:
- A. Ambient temperature, 0-40 degrees C.
 - B. 0-95% relative humidity, non-condensing.
 - C. Elevation to 3300 feet without derating.
 - D. AC line voltage variation, -5% to 10% of nominal.
- 2.6 SPECIAL FEATURES: The following special features shall be included in the VSMC enclosure. The unit shall maintain its U.L. or ETL listing.
- A. A motor starter shall be included in the bypass circuitry for constant speed motor control when the VSMC is taken out of service. Manual bypass shall provide all the circuitry necessary to transfer the motor from the VSMC to the power line, or from the line to the controller while the motor is at zero speed. The bypass circuitry shall be mounted in a separate section of the VSMC enclosure. Two motor contactors, electrically interlocked, shall be utilized. One contactor is to be between the controller and the motor. The other contactor is to be between the bypass power line and the motor providing across-the-line starting. Motor overload protection is to be provided in both the controller mode and the bypass mode. The bypass section door shall include a "drive/line" switch, "on/off-reset" switch, and a "load transferred to line" pilot light.
 - B. The VSMC shall include a main fused disconnect switch or circuit breaker to provide a means of disconnecting all power to both the bypass circuitry and the controller. The disconnect switch or circuit breaker shall be door interlocked and padlockable. The fuses or circuit breaker shall be sized to provide short circuit protection for the motor when in the bypass mode per the NEC.
 - C. A second disconnect switch, circuit breaker, or contactors shall be provided to disconnect input power to the controller but not the bypass circuitry. This disconnect will allow troubleshooting and testing of the VSMC, both energized and de-energized while operating in the bypass mode.
 - D. Plug-in test meter shall provide a quick means for monitoring the different signals within the VSMC for start-up and troubleshooting. Where the meter is capable of operating with different horsepower VSMCs, only one meter needs to be supplied.

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- E. A critical frequency avoidance circuit shall be provided for VSMCs serving CT-1 to avoid operation at speeds which cause excessive vibration in the driven equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The manufacturer of the VSMC equipment shall provide a competent, factory trained service technician to supervise the installation, start-up and testing of the VSMC.
- B. Install VSMCs in locations shown on the drawings in strict accordance with the manufacturer's published installation instructions.
- C. Contractor shall provide such materials and assistance as required by the manufacturer's representative.
- D. Division 26 shall provide necessary electrical connections.
- E. Contractor shall provide coordination of the necessary controls not provided by the VSMC manufacturer.

3.2 START-UP, TESTING, DEMONSTRATION

- A. The manufacturer's factory-trained service technician, assisted by contractor, shall verify correct installation, start-up equipment, and test it as a unit and a part of the system it serves. Verify by adjustments, tests, etc., that the equipment is functioning as specified. Provide three copies of test data to the Owner. As a minimum, check the following items:
 - 1. Motor voltage and frequency.
 - 2. Control input and automatic start/stop.
 - 3. Calibration and adjustment for minimum and maximum speed setpoints and acceleration and deceleration rates.
 - 4. Wire terminations.
- B. VSMC manufacturer shall provide a minimum of 4 hours instruction to Owner to demonstrate the operation of the system. Provide three copies of operation and maintenance manual to Owner at completion of instructions.

END OF SECTION

SECTION 23-0963
BUILDING AUTOMATION SYSTEMS

PART 1 - GENERAL

1.1 OVERVIEW

- A. Furnish all labor, materials, and components for a complete and operating DDC based temperature control system as described herein and as shown on the controls drawings.

- B. SECTION INCLUDES
 - 1. Products Furnished But Not Installed Under This Section
 - 2. Products Installed But Not Furnished Under This Section
 - 3. Related Sections
 - 4. Description
 - 5. Approved Control System
 - 6. Quality Assurance
 - 7. System Performance
 - 8. Submittals
 - 9. Warranty

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 23 21 13 – Pipe and Pipe Fittings and Section 23 21 14 - Valves
 - 1. Control Valves
 - 2. Flow Switches
 - 3. Temperature Sensor Wells and Sockets

- B. Section 23 33 00 – Sheet Metal Accessories:
 - 1. Automatic Dampers
 - 2. Air-flow Stations

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Sections 23 64 27, or 23 64 16 –Water Chillers:
 - 1. Pressure Transmitters
 - 2. Temperature Transmitters
 - 3. Power Transmitters
 - 4. Refrigerant Leak Detectors

- B. Section 23 81 19.16 – Rooftop A/C Unit and/or Section 23 76 13 Air Handling Units

1.4 RELATED SECTIONS

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- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of these Specifications and shall be used in conjunction with this Section as a part of the Contract Documents. Consult them for further instructions pertaining to this work.

1.5 DESCRIPTION

- A. General: The control system shall be as indicated on the drawings and described in the specifications. The control system specified shall be protocol neutral and shall communicate at the system (building controller level) using the ANSI/ASHRAE Standard 135-2004 (BACnet) over IP protocol. The unit level shall communicate using BACnet/MSTP, LonTalk or Modbus open standard protocols. No proprietary communication protocol is acceptable. All monitor and control points shown on the drawings and all alarms shall be mapped through to the front end workstation and integrated into the graphics.
- B. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems on this project per the control drawings.
- C. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by operator password. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.
- D. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.
- E. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. The operator shall not have to know the panel identifier or location to view or control an object. Application Specific Controllers shall be constantly scanned by the network controllers to update point information and alarm information.
- F. Communication between control system and onsite/offsite monitoring and control station via internal LAN and/or internet shall be provided. Access to the system from any onsite/offsite computers shall be provided through a web browser without the need for any system specific software on the accessing computer
- G. The documentation is schematic in nature. The Contractor shall provide hardware and software necessary to implement the functions and sequences shown.

1.6 APPROVED CONTROL SYSTEM

- A. Approved Control System:
 - 1. Trane Company -Tracer SC

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2. Honeywell
3. Johnson Controls - Metasys
4. Siemens - Apogee
5. Automated Logic
6. Delta Controls
7. Approved Equal

1.7 QUALITY ASSURANCE

A. System Installer Qualifications

1. The Installer shall have an established working relationship with the Control System Manufacturer of not less than three years.
2. The Installer shall have successfully completed Control System Manufacturer's training on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
3. The above manufacturer applies to operator workstation software, controller software, the custom application programming language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturer.

B. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.

1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
2. Underwriters Laboratories: Products shall be UL-864 Smoke control equipment listed (if smoke control system is employed).
3. National Electrical Code -- NFPA 70.
4. Federal Communications Commission -- Part J.
5. ASHRAE/ANSI 135-1995 (BACnet)

C. All products used in this installation shall be new, currently under manufacture, and shall be applied in similar installations. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's representative in writing prior to installation and shall be available for at least 5 years after completion of this contract.

1.8 SYSTEM PERFORMANCE

A. Performance Standards. The system shall conform to the following:

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1. Graphic Display. The system shall display a graphic with dynamic points.
2. Graphic Refresh. The system shall update all dynamic points with current data within 30 seconds.
3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 10 seconds. Analog objects shall start to adjust within 10 seconds.
4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior 60 seconds.
5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Performance. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
8. Multiple Alarm Annunciation. All workstations on the network shall receive alarms within 5 seconds of each other.
9. Reporting Accuracy. Table 1 lists minimum acceptable reporting accuracies for all values reported by the specified system.

Table I -- Reporting Accuracy

Measured Variable	Reported Accuracy
Space temperature	±0.5°C [±1°F]
Ducted air	±1.0°C [±2°F]
Outside air	±1.0°C [±2°F]
Water temperature	±0.5°C [±1°F]
Delta-T	±0.15°C [±0.25°F]
Relative humidity	±2% RH
Water flow	±5% of full scale
Air flow (terminal)	±10% of reading *Note 1
Air flow (measuring stations)	±5% of reading
Air pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air pressure (space)	±3 Pa [±0.01 "W.G.]
Water pressure	±2% of full scale *Note 2
Electrical Power	5% of reading *Note 3

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Carbon Monoxide (CO)	± 50 PPM
Carbon Dioxide (CO ₂)	± 50 PPM

Note 1: (10%-100% of scale) (cannot read accurately below 10%)

Note 2: for both absolute and differential pressure

Note 3: * not including utility supplied meters

1.9 SUBMITTALS

- A. Contractor shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software to be provided. No work may begin on any segment of this project until the Engineer has reviewed submittals for conformity with the plan and specifications. Five (5) copies are required.
- B. Quantities of items submitted shall be reviewed by the Engineer. Such review shall not relieve the contractor from furnishing quantities required for completion.
- C. Provide the Engineer, any additional information or data that is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.
- D. Submit the following within 60 days of contract award:
 - 1. A complete bill of materials of equipment to be used indicating quantity, manufacturer and model number.
 - 2. A schedule of all control valves including the valve size, model number (including pattern and connections), flow, CV, pressure rating, and location.
 - 3. A schedule of all control dampers. This shall include the damper size, pressure drop, manufacturer and model number.
 - 4. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:
 - a) Building Controllers
 - b) Custom Application Controllers
 - c) Application Specific Controllers
 - d) Operator Interface Computer
 - e) Portable Operator Workstation
 - f) Auxiliary Control Devices
 - g) Proposed control system riser diagram showing system configuration, device locations, addresses, and cabling.
 - h) Detailed termination drawings showing all required field and factory terminations. Terminal numbers shall be clearly labeled.

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- i) Points list showing all system objects and the proposed English language object names.
 - j) Sequence of operations for each system under control. This sequence shall be specific for the use of the Control System being provided for this project.
 - k) Provide a BACnet Product Implementation Conformance Statement (PICS) for each BACnet device type in the submittal if required by the project scope.
 - l) Color prints of proposed graphics with a list of points for display.
- E. Project Record Documents: Upon completion of installation submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:
- 1. Project Record Drawings - These shall be as-built versions of the submittal shop drawings.
 - 2. Testing and Commissioning Reports and Checklists.
 - 3. Operating and Maintenance (O & M) Manual - These shall be as built versions of the submittal product data. In addition to that required for the submittals, the O & M manual shall include:
 - (a) Names, address and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representative of each.
 - (b) Operators Manual with procedures of operating the control systems including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
 - (c) Programming Manual with a description of the programming language including syntax, statement descriptions including algorithms and calculations used, point database creation and modification, program creation and modification, and use of the editor.
 - (d) Engineering, Installation and Maintenance Manual(s) that explains how to design and install new points, panels, and other hardware; preventative maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
 - (e) A listing and documentation of all custom software created using the programming language including the point database. One set of magnetic media containing files of the software and database shall also be provided.
 - (f) One set of electronic media containing files of all color-graphic screens created for the project.
 - (g) A list of recommended spare parts with part numbers and supplier.
 - (h) Complete original issue documentation, installation, and maintenance information for all third party hardware provided including computer equipment and sensors.

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- (i) Complete original issue media for all software provided including operating systems, programming language, operator workstation software, and graphics software.
- (j) Licenses, Guarantee, and Warrantee documents for all equipment and systems.
- (k) Recommended preventive maintenance procedures for all system components including a schedule of tasks (inspection, cleaning, calibration, etc.) time between tasks, and task descriptions.

1.10 WARRANTY

A. Warrant all work as follows:

- 1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner.
- 2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of warranty.
- 3. The system provider shall provide a web-accessible Users Network to give the Owner access to question/answer forum, graphics library, user tips, and training schedules.

PART 2 - PRODUCTS

2.1 SECTION INCLUDES

- A. Operator Interface
- B. System Software
- C. Building Controllers
- D. Custom Application Controllers
- E. Application Specific Controllers
- F. Communications
- G. Input/Output Interface
- H. Auxiliary Control Devices

2.2 OPERATOR INTERFACE

- A. Operator Interface. Furnish 1 PC based workstations as shown on the system drawings and one additional operator interface software package for the owner to install at the location of his choice. Each of these workstations shall be able to access all information in the system. These workstations shall reside on the same high-speed network as the building controllers, and also be able to dial into the system.

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B. Hardware Platform:

1. Personal Computer. Furnish IBM-compatible PCs as shown on the drawings.

C. System Software

1. Operating System. Furnish a commercially available, concurrent multi-tasking operating system. The operating system shall also support the use of other common software applications that operate under Microsoft Windows. Acceptable operating systems are Windows XP or more recent OS.
2. System Graphics. The Operator Workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on line. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation of equipment. Graphics shall be capable of launching other PC applications.
 - (a) Custom Graphics. Custom graphic files shall be created with the use of commonly available graphics packages such as PC Paint. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as PCX, BMP, GIF and JPEG. The graphics generation package shall also provide the capability of capturing or converting graphics from other programs such as Designer, or AutoCAD.
 - (b) Graphics Library. Furnish a complete library of standard HVAC equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library shall also include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
 - (c) Engineering Units. Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system. Unit selection shall be able to be customized by locality to select the desired units for each measurement. Engineering units on this project shall be: Standard Inch Pound.

D. System Applications. Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation.

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1. In the event of a database loss in a building management panel, the first workstation to detect the loss shall automatically restore the database for that panel.
2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to archive the database from any system panel and store on magnetic media. The operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
3. System Configuration. The workstation software shall provide a graphical method of configuring the system. The user with proper security shall be able to add new devices, and assign modems to devices. This shall allow for future system changes or additions.
4. On-Line Help and Training. Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. Provide an interactive tutorial CD, which will act as on-line training/help for the systems operator.
5. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time shall be set per operator password. All system security data shall be stored in an encrypted format.
6. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.
 - (a) Alarm Reactions. The operator should be able to determine what actions, if any, are to be taken, by object (or point), during an alarm. Actions can include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, forwarding to an e-mail address, providing audible annunciation or displaying specific system graphics. An object in alarm that has not been acknowledged within an operator specified time period

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shall be re-routed to an alternate operator specified alarm receipt device.

- (b) Binary Alarms. Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to disable alarming when the associated equipment is turned off or is being serviced.
 - (c) Analog Alarms. Each analog object shall have both high and low alarm limits and warning limits. Alarming must be able to be automatically and manually disabled.
8. Trend Logs. The operator shall be able to define a custom trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals of 1, 5, 15, 30, and 60 minutes as well as once a shift (8 hours), once a day, once a week, and once a month shall be selectable. All trends shall start based on the hour. Each trend shall accommodate up to 64 system objects. The system operator with proper password shall be able to determine how many samples are stored in each trend. Trend data shall be sampled and stored on the Building Controller panel and be archived on the hard disk. Trend data shall be able to be viewed and printed from the operator interface software. Trends must be viewable in a text-based format or graphically. They shall also be storable in a tab delimited ASCII format for use by other industry standard word processing and spreadsheet packages.
9. Dynamic Graphical Charting. The operator shall be able to select system values to be charted in real time. Up to three values at one time can be selected for each chart. The type of chart (bar, line, 3-D, etc.) shall be selectable.
10. Alarm and Event Log. The operator shall be able to view all logged system alarms and events from any location in the system. The operator shall be able to sort and filter alarms. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation.
11. Object and Property Status and Control. Provide a method for the operator with proper password protection to view, and edit if applicable, the status of any object and property in the system. These statuses shall be available by menu, on graphics, or through custom programs.
12. Clock Synchronization. The real time clocks in all building control panels and workstations shall be synchronized on command of an operator. The system shall also be able to automatically synchronize all system clocks; daily from any operator designated device in the system. The system shall automatically adjust for daylight savings and standard time if applicable.

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13. Reports and Logs. Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archived on the hard disk for historical reporting. Provide the ability for the operator to obtain real time logs of designated lists of objects. Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. The operator shall be able to designate reports that shall be printed or stored to disk at selectable intervals.
- (a) Custom Reports: Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.
 - (b) Standard Reports. The following standard system reports shall be provided for this project. These reports shall be readily customized to the project by the owner.
 - (i) Weather Data Report: The system shall be capable of providing a monthly report showing the daily minimum, maximum and average outdoor air temperature and the number of heating and cooling degree days for each day. Provide an annual (12 month) report showing the minimum, maximum and average outdoor air temperature for the month and the number of heating and cooling degree days for the month.
 - (ii) ASHRAE Guideline 3-1996 Report: The system shall be capable of providing a daily report that shows the operating condition of each chiller as required by ASHRAE Guideline 3. At minimum this report shall include:
 - 1) Chilled Water (or other fluid) inlet and outlet temperature
 - 2) Chilled Water (or other fluid) flow
 - 3) Chilled Water (or other fluid) inlet and outlet pressures
 - 4) Evaporator refrigerant pressure and temperature
 - 5) Condenser refrigerant pressure and liquid temperature
 - 6) Condenser water inlet and outlet temperatures
 - 7) Condenser water flow
 - 8) Refrigerant levels
 - 9) Oil pressure and temperature
 - 10) Oil level (if applicable)
 - 11) Compressor refrigerant discharge temperature
 - 12) Compressor refrigerant suction temperature
 - 13) Manual entry field for addition of refrigerant
 - 14) Manual entry field for addition of oil
 - 15) Manual entry field for vibration levels
 - 16) Motor amperes per phase
 - 17) Motor volts per phase

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- 18) PPM refrigerant monitor levels
- 19) Purge exhaust time or discharge count
- 20) Ambient temperatures (dry bulb and wet bulb)
- 21) Date and time data logged

- E. Workstation Applications Editors - Each PC workstation shall support full screen editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at the appropriate controller panels.
1. Controller. Provide a full screen editor for each type controller and application that shall allow the operator with proper password to view and change the configuration, name, control parameters, and system set-points.
 2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The advance and delay time for each object shall be adjustable from this master schedule.
 - (a) An operator with proper password level shall be able to modify the schedule. Schedules shall be able to be easily copied between objects and/or dates.
 3. Air System Equipment Coordination. Provide a full screen editor that allows equipment to be grouped for proper operation as specified in the sequence of operations. This shall include the coordination of VAV boxes with their associated Air Handling Equipment.
 4. Chiller System - The chiller plant control application shall be configured using a full screen editor and shall provide operating status for the system. The display shall include:
 - (a) System mode of the chiller plant
 - (b) Chiller enable/disable status
 - (c) System supply water setpoint
 - (d) System supply and return water temperature
 - (e) System Chilled water pump status
 - (f) System Chilled water flow
 - (g) Bypass pipe flow rate (if applicable)
 - (h) Current chiller plant control operation
 - (i) Add information
 - (j) Subtract information
 - (k) System failure information
 - (l) Chiller failure information
 - (m) Rotation information
 - (n) Override capabilities to force an add control, subtract control, or change of sequence.

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- (o) Remove a chiller from a sequence temporarily for service purposes.
5. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded. The programming language shall have the following features:
- (a) The language shall be English language oriented and be based on the syntax of programming languages such as BASIC. It shall allow for free form or fill in the blank programming. Alternatively, the programming language can be graphically-based using function blocks as long as blocks are available that directly provides the functions listed below, and that custom or compound function blocks can be created.
 - (b) A full screen character editor/programming environment shall be provided. The editor shall be cursor/mouse-driven and allow the user to insert, add, modify, and delete code from the custom programming. It shall also incorporate word processing features such as cut/paste and find/replace.
 - (c) The programming language shall allow independently executing program modules to be developed. Each module shall be able to independently enable and disable other modules.
 - (d) The editor/programming environment shall have a debugging/simulation capability that allows the user to step through the program and to observe any intermediate values and or results. The debugger shall also provide error messages for syntax and execution errors.
 - (e) The programming language shall support conditional statements (IF/THEN/ELSE/ELSE-IF) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
 - (f) The programming language shall support floating point arithmetic using the following operators: +, -, /, x, square root, and xy. The following mathematical functions shall also be provided: natural log, log, absolute value, and minimum/maximum value from a list of values.
 - (g) The programming language shall have pre-defined variables that represent clock time, day of the week, and date. Variables that provide interval timing shall also be available. The language shall allow for computations using these values.

- (h) The programming language shall have ability to pre-defined variables representing the status and results of the System Software.

2.4 SYSTEM SOFTWARE

- A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator workstation.
- B. System Security
 - 1. User access shall be secured using individual security passwords and user names.
 - 2. Passwords shall restrict the user to only the objects, applications, and system functions as assigned by the system manager.
 - 3. User logon/logoff attempts shall be recorded.
 - 4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
- C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:
 - 1. Weekly Schedule. Provide separate schedules for each day of the week.
 - 2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.
 - 3. Holiday Schedules. Provide the capability for the operator to define up to [99] special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
 - 4. Optimal Start/Stop. The scheduling application outlined above shall support an optimal start/stop algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less than and greater than 24

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hours. Provide the ability to modify the start/stop algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.

- D. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions. An alarm shall be able to start programs, be logged in the event log, printed, generate custom messages graphics.
- E. Remote Communications. The system shall have the ability to dial out in the event of an alarm. Receivers shall include PC Workstations, and alphanumeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system using dial up communications in the same format and method used on site under section 2.1 (Operator Interface).
- F. Demand Limiting.
 - 1. The demand limiting program shall monitor building power consumption from signals generated by a pulse generator (provided by others) mounted at the building power meter, or from a watt transducer or current transformer attached to the building feeder lines.
 - 2. The demand limiting program shall be based on a predictive sliding window algorithm. The sliding window duration and sampling interval shall be set equal to that of the local Electrical Utility.
 - 3. Control system shall be capable of demand limiting by resetting HVAC system set-points to reduce load while maintaining Indoor Air Quality (humidity, VOC, CO2) and comfort control in the space.
 - 4. Input capability shall also be provided for an end-of-billing period indication.
- G. Maintenance Management. The system shall monitor equipment status and be capable of generating maintenance messages based upon user designated run time, starts, and/or calendar date limits.
- H. Chiller Sequencing: Provide applications software to properly sequence the chiller plant to minimize energy use. This application shall perform the following functions:
 - 1. The chiller plant control application shall have the ability to control a maximum of 25 chillers of any type including centrifugal, helirotor, scroll, and reciprocating and absorption machines as detailed in the sequence of operations.
 - 2. This application shall be able to control both constant and variable flow systems as well as parallel, series and decoupled piping configurations.

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3. The chiller plant control application shall be able to control multiple chiller plants per site.
 4. Diagnostics/Protection - the chiller plant application program shall be able to integrate individual chiller diagnostics into control action decisions.
 5. Event Processing - All chiller plant control and status events shall be recorded, at the operator's selection, in the building management system event log to facilitate troubleshooting.
 6. Alarm Indications - The chiller plant control status screens shall display chiller plant and individual chiller alarm messages.
 7. Add/Subtract actions – The status screens shall provide information on when the next chiller add or subtract action will occur. The operator shall have the ability to manually force a chiller addition or a chiller subtraction.
- I. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs. The controlled variable, set-point, and PID gains shall be user-selectable. The set-point shall optionally be chosen to be a reset schedule.
 - J. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts shall be user-selectable.
 - K. System Calculations. Provide software to allow instantaneous power (e.g. KW), flow rates (e.g. GPM) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window KW demand value. Provide an algorithm that calculates energy usage and weather data (heating and cooling degree days). These items shall all be available for daily, previous day, monthly and the previous month.
 - L. Anti-Short Cycling. All binary output points shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

2.5 BUILDING CONTROLLERS

- A. General. Provide Building Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.
 1. The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based Building Controllers to manage the global strategies described in System software section.
 2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.

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3. The controller shall provide a communications port for connection to the inter-network.
 4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 5. Controllers that perform scheduling shall have a real time clock.
 6. Data shall be shared between networked Building Controllers.
 7. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
 - (a) Assume a predetermined failure mode.
 - (b) Generate an alarm notification.
- B. Each Building Controller shall also perform routing to a network of Custom Application and Application Specific Controllers.
- C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at 0 C to 50 C [32 F to 120 F].
- D. Serviceability. Provide diagnostic LEDs for power, communications, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.
- E. Memory. The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage

2.6 CUSTOM APPLICATION CONTROLLERS

- A. General. Provide Custom Application Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.
1. The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based Building Controllers to manage the local strategies described in System software section.
 2. The Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 3. Controllers that perform scheduling shall have a real time clock.

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4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 5. The Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
 - (a) Assume a predetermined failure mode.
 - (b) Generate an alarm notification.
- B. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
1. Controller used in conditioned ambient shall be mounted in NEMA 1 type enclosures, and shall be rated for operation at 0 C to 50 C [32 F to 120 F].
 2. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40 C to 70 C [-40 F to 158 F].
- C. Serviceability. Provide diagnostic LEDs for power, communications, and processor. All low voltage wiring connections shall be made such that the controller electronics can be removed and/or replaced without disconnection of field termination wiring.
- D. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- E. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

2.7 APPLICATION SPECIFIC CONTROLLERS

- A. General. Application specific controllers (ASC) are microprocessor-based DDC controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user programmable, but are customized for operation within the confines of the equipment they are designed to serve.
1. Each ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
 2. Each ASC will contain sufficient I/O capacity to control the target system.
- B. Environment. The hardware shall be suitable for the anticipated ambient conditions.

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1. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40 C to 65 C [-40 F to 150 F].
 2. Controller used in conditioned ambient shall be mounted in NEMA 1 type rated enclosures. Controllers located where not to be disturbed by building activity (such as above ceiling grid), may be provided with plenum-rated enclosures and non-enclosed wiring connections for plenum cabling. All controllers shall be rated for operation at 0 C to 50 C [32 F to 120 F].
- C. Serviceability. Provide diagnostic LEDs for power and communications. All wiring connections shall be clearly labeled and made to be field removable.
- D. Memory. The Application Specific Controller shall maintain all BIOS and programming information in the event of a power loss for at least 90 days.
- E. Immunity to Power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%.
- F. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.

2.8 COMMUNICATIONS

- A. This project shall comprise a network utilizing communications between Building Controllers and PC Workstations.
- B. The controls Contractor shall provide all communication media, connectors, repeaters, hubs, and routers necessary for the inter-network.
- C. All Building Controllers shall have a communications port for connections with the operator interfaces. This may be either an RS-232 port for Point to Point connection or a network interface node for connection to the Ethernet or ARCNET network.

2.9 INPUT/OUTPUT INTERFACE

- A. Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices.

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- D. Pulse accumulation input points. This type of point shall conform to all the requirements of Binary Input points, and also accept up to 2 pulses per second for pulse accumulation, and shall be protected against effects of contact bounce and noise.
- E. Analog inputs shall allow the monitoring of low voltage (0-10 Vdc), current (4-20 ma), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.
- F. Binary outputs shall provide for on/off operation, or a pulsed low voltage signal for pulse width modulation control. Outputs shall be selectable for either normally open or normally closed operation.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0-10 Vdc or a 4-20 ma signal as required to provide proper control of the output device.

2.10 AUXILIARY CONTROL DEVICES

- A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:
 - 1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.
 - 2. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.
 - 3. Damper shaft bearings shall be as recommended by manufacturer for application.
 - 4. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.
 - 5. All leakage testing and pressure ratings will be based on AMCA Publication 500.
 - 6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.
- B. Control dampers shall be parallel or opposed blade types as scheduled on drawings.
- C. Electronic damper/valve actuators.
 - 1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

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2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.
 3. All rotary spring return actuators shall be capable of both clockwise and counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.
 4. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.
 5. All 24 VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 W for DC applications. Actuators operating on 120 VAC or 230 VAC shall not required more than 11 VA.
 6. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
 7. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
 8. Actuators shall be Underwriters Laboratories Standard 873 listed.
 9. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.
- D. Control Valves
1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.
 2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - (a) Water Valves:
 - (i) Two-way: 150% of total system (pump) head.
 - (ii) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - (b) Steam Valves: 150% of operating (inlet) pressure.
 3. Water Valves:
 - (a) Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - (b) Sizing Criteria:

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- (i) Two-position service: Line size.
 - (ii) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
 - (iii) Three-way Modulating Service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 5 psi maximum.
 - (iv) Valves 1/2" through 2" shall be bronze body or cast brass ANSI Class 250, spring loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.
 - (v) 2-1/2" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.
- (c) Water valves shall fail normally open or closed as scheduled on plans or as follows:
- (i) Heating coils in air handlers - normally open.
 - (ii) Chilled water control valves - normally closed.
 - (iii) Other applications - as scheduled or as required by sequence of operation.
- (d) Zone valves shall be sized to meet the control application and they shall maintain their last position in the event of a power failure.

4. Steam Valves:

- (a) Body and trim materials shall be per manufacturer's recommendations for design conditions and service. Linear ports for modulating service.
- (b) Sizing Criteria:
 - (i) Two-position service: pressure drop 10% to 20% of inlet psig.
 - (ii) Modulating service 15 psig or less: pressure drop 80% of inlet psig.
 - (iii) Modulating service 16 to 50 psig: pressure drop 50% of inlet psig.
 - (iv) Modulating service over 50 psig: pressure drop as scheduled on plans.

E. TEMPERATURE SENSORS

1. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.
2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 5 feet in length.

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3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
4. Space sensors shall be equipped with set-point adjustment, digital display, override switch.
5. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.2 F.

F. HUMIDITY SENSORS

1. Duct and room sensors shall have a sensing range of 20% to 80% with accuracy of $\pm 2\%$ R.H.
2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% R.H. It shall be suitable for ambient conditions of -40 F to 170 F.
4. Humidity sensor's drift shall not exceed 1% of full scale per year.

G. STATIC PRESSURE SENSORS

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.
2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.
3. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.
4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

H. LOW LIMIT THERMOSTATS

1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section.
2. Low limit shall be manual reset only.

I. INDOOR AIR QUALITY SENSORS

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1. Indoor air quality sensors, if required, shall measure both total percentage VOCs and CO₂ in PPM (see control drawings). Sensors shall be duct or space mounted.

J. FLOW SWITCHES

1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
2. Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 Type enclosure unless otherwise specified:
3. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.
4. Current sensing relays may be used for flow sensing or terminal devices.

K. RELAYS

1. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.
2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

L. TRANSFORMERS and POWER SUPPLIES

1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
3. Unit shall operate between 0 C and 50 C.
4. Unit shall be UL recognized.

M. CURRENT SWITCHES

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1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

N. LOCAL CONTROL PANELS

1. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with [hinged door], key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.
2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Provide on/off power switch with over-current protection and main air gauge for control power sources to each local panel.

O. AIRFLOW MONITORING STATIONS (Paragons in the inlet of supply and return fans)

1. Airflow monitoring stations shall be provided for the purpose of monitoring and controlling the outside air intake to the building and maintaining a net positive building pressure. The controls contractor shall provide the following scheme for controlling the building pressure and the associated controls logic and airflow measuring devices to accomplish the sequence as shown on the controls drawing. The chosen method shall be submitted in detail for approval prior to the control system design.
 - (a) Scheme – Provide AFS devices in each fan inlet of the supply and return fans to provide a fixed differential CFM between the supply and return fans.
2. AFS devices shall utilize either pitot type averaging sensor probes or thermal dispersion technology probes designed for placement in the inlet bell or barrel of a centrifugal, plug, in-line centrifugal, or vane axial fan. Sensor accuracy for airflow shall be +/- 2% of reading over the sensor probe operating range. The AFS system shall be provided with a transmitter that provides for a total airflow measuring accuracy within +/- 1% of reading over the sensor probe operating range.
3. Acceptable Manufacturers
 - (a) Paragon FE-1050 sensing element and Microtrans transducer

P. WATERFLOW SENSORS

1. Water flow sensors shall be constructed of 316 stainless steel and suitable for applications from 35 to 220 degF and 200 psi. The meter

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shall be provided with ball type isolation valve and all necessary mounting hardware. The meter shall also be provide with insertion/retraction tools and hardware in order that the meter may be removed under pressure and serviced without interruption to the system operation. Sensor accuracy shall be 1% of full scale between 1 and 30 feet per second of flow velocity. The meter shall be

2. Acceptable Manufacturers
 - (a) Badger Meters

PART 3 - EXECUTION

3.1 SECTION INCLUDES:

- A. Controls Systems Meeting
- B. Examination
- C. General Workmanship
- D. Wiring
- E. Installation of Sensors
- F. Flow Switch Installation
- G. Actuators
- H. Warning Labels
- I. Identification of Hardware and Wiring
- J. Controllers
- K. Programming
- L. Cleaning
- M. Protection
- N. Training
- O. Field Quality Control
- P. Check-out, Start-up, and Testing
- Q. Acceptance

3.2 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment is installable as shown, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.3 GENERAL WORKMANSHIP

- A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

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- C. Install all equipment in readily accessible location as defined by chapter 1 article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.4 WIRING

- A. All control and interlock wiring shall comply with the national and local electrical codes and Division 26 of these specifications. Where the requirements of this section differ with those in Division 26, the requirements of this section shall take precedence.
- B. Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that:
 - 1. Circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
 - 2. All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.
- C. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
- D. Where class 2 wiring is run exposed, wiring shall be run parallel along a surface or perpendicular to it, and bundled, using approved wire ties at no greater than 10 ft intervals. Such bundled cable shall be fastened to the structure, using specified fasteners, at 5 ft intervals or more often to achieve a neat and workmanlike result.
- E. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to-wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- F. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the Control System Contractor shall provide step down transformers.
- G. All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.

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- H. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with other sections of this specification and local codes.
- I. Size of conduit and size and type of wire shall be the design responsibility of the Control System Contractor, in keeping with the manufacturer's recommendation and NEC.
- J. Control and status relays are to be located in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class 1 starter enclosures.
- K. Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.
- L. Adhere to Division 26 requirements for installation of raceway.
- M. This Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- N. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.

3.5 INSTALLATION OF SENSORS

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequate for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.
- E. Install duct static pressure tap with tube end facing directly down-stream of air flow.
- F. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
- G. All pipe mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat conducting fluid in thermal wells.

- H. Wiring for space sensors shall be concealed in building walls. EMT conduit is acceptable within mechanical and service rooms.
- I. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.

3.6 FLOW SWITCH INSTALLATION

- A. Install using a thread-o-let in steel pipe. In copper pipe use C x C x F Tee, no pipe extensions or substitutions allowed.
- B. Mount a minimum of 5 pipe diameters upstream and 5 pipe diameters downstream or 2 feet whichever is greater, from fittings and other obstructions.
- C. Install in accordance with manufacturers' instructions.
- D. Assure correct flow direction and alignment.
- E. Mount in horizontal piping - flow switch on top of the pipe.

3.7 ACTUATORS

- A. Mount and link control damper actuators per manufacturer's instructions.
- B. To compress seals when spring return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
- C. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
- D. Valves - Actuators shall be mounted on valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following manufacturer's recommendations.

3.8 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 1-cm letters on laminated plastic nameplates.
- D. Identify all other control components with permanent labels. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.9 CONTROLLERS

- A. Provide a separate Controller for each major piece of HVAC equipment. Points used for control loop reset such as outside air or space temperature are exempt from this requirement.
- B. Future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.10 PROGRAMMING

- A. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 10% of available memory free for future use.
- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.
- C. Software Programming
 - 1. Provide programming for the system as per specifications and adhere to the strategy algorithms provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the Control System Contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.
- D. Operators' Interface
 - 1. Standard Graphics. Provide graphics for each major piece of equipment and floor plan in the building. This includes each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These standard graphics shall show all points dynamically as specified in the points list.
 - 2. The controls contractor shall provide all the labor necessary to install, initialize, start-up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any third party software installation and integration required for successful operation of the operator interface.
 - 3. As part of this execution phase, the controls contractor will perform a complete test of the operator interface. Test duration shall be a minimum of 8 hours on-site. Tests shall be made in the presence of the Owner or Owner's representative.
- E. Demonstration: A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 16 hours on-site with the Owner and his representatives for a

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complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation.

3.11 CLEANING

- A. This contractor shall clean up all debris resulting from his or her activities daily. The contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.
- B. At the completion of work in any area, the Contractor shall clean all of his/her work, equipment, etc., making it free from dust, dirt and debris, etc.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.12 PROTECTION

- A. The Contractor shall protect all work and material from damage by his/her work or workers, and shall be liable for all damage thus caused.
- B. The Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.13 TRAINING

- A. Provide a minimum of 2 classroom training sessions, 8 hours each, throughout the contract period for personnel designated by the Owner. Computer based training may be substituted for up to 6 hours of hands on training.
- B. Train the designated staff of Owner's representative and Owner to enable them to proficiently operate the system; create, modify and delete programming; add, remove and modify physical points for the system; add additional panels when required.
- C. These objectives will be divided into three logical groupings; participants may attend one or more of these, depending on level of knowledge required:
 - 1. Day-to-day Operators
 - 2. System Troubleshooter
 - 3. System Manager

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- D. Provide course outline and materials as per Part 1 of this Section. The instructor(s) shall provide one copy of training material per student.
- E. Classroom training shall be done using a network of working controllers at the customer's site.

3.14 FIELD QUALITY CONTROL

- A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.
- C. Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.15 ACCEPTANCE

- A. The control systems will not be accepted as meeting the requirements of Completion until all tests described in this specification have been performed to the satisfaction of both the Engineer and Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.
- B. The controls contractor shall provide a technician for the purpose of assisting the commissioning of the HVAC systems and demonstrating the controls aspects of the HVAC systems functions. The technician shall be made available through the commissioning process.

3.16 INSTALLATION INSTRUCTIONS TO OTHER SECTIONS

- A. CONTROL VALVE INSTALLATION (BY OTHER SECTIONS)
 - 1. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.
 - 2. All control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position.
 - 3. Valves shall be installed in accordance with the manufacturer's recommendations.
 - 4. Control valves shall be installed so that they are accessible and serviceable, and such that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.

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5. Isolation valves shall be installed such that control valve body may be serviced without draining the supply/return side piping system. {Note to designer: this must also be shown.} Unions shall be installed at all connections to screwed type control valves.
6. Provide tags for all control valves indicating service and number. Tags shall be brass, 1-1/2" in diameter, with 1/4" high letters. Securely fasten with chain and hook. Match identification numbers as shown on approved controls shop drawings.

B. DAMPER INSTALLATION (BY OTHER SECTIONS)

1. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
2. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure 1/4" larger than damper dimensions and shall be square, straight, and level.
3. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be equal $\pm 1/8"$.
4. Follow manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
5. Install extended shaft or jackshaft per manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)
6. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to assure proper operation. On multiple section assemblies, all sections must open and close simultaneously.
7. Provide a visible and accessible indication of damper position on the drive shaft end.
8. Support duct-work in area of damper when required to prevent sagging due to damper weight.
9. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

C. DUCT SMOKE DETECTOR INSTALLATION (BY OTHER SECTIONS)

1. Provide complete submittal data to controls system contractor for coordination of duct smoke detector interface to HVAC systems.

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2. The Division 26 contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

END OF SECTION

SECTION 23-2113
HYDRONIC PIPING AND PIPE FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Submit pipe, valves, and fittings and have approved before starting installation. Pipe, valves, and fittings to be new and marked clearly with manufacturers' name, weight, and classification or working pressure.
- B. Piping to be run approximately as shown on drawings or as structural and architectural conditions permit.

1.2 RELATED WORK

- A. Hangers and supports - Section 23 05 29
- B. Mechanical System Insulation - Section 23 07 13 and 23 07 19

1.3 QUALITY ASSURANCE

- A. Standards: All pipe and fittings shall conform to ANSI and appropriate ASTM Standards.
- B. Piping shown on drawings shall be installed complete and of the size indicated on the drawings. Pipe sizes are nominal size (inches) unless otherwise noted.

PART 2 - PRODUCTS

2.1 STEEL PIPES

- A. Electric resistance welded or seamless black steel pipe, ANSI B 36.10, ASTM A-53, Grade "B", Schedule 40, for piping 10" and smaller and standard weight for pipe sizes 12" and larger. Provide for the following services:
 - 1. Chilled water supply and return piping 2-1/2" and larger.
- B. Standard-weight galvanized steel pipe:
 - 1. Air conditioning moisture condensate drain piping.

2.2 STEEL PIPE FITTINGS

- A. Fittings 2-1/2" and larger to be standard weight, carbon steel, buttwelded conforming to ASTM A234-WPB, ANSI B16.9, B16.28.

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- B. Branch connections from mains or headers 2-1/2" or larger to be tees, or welding outlets. Outlets to be equal to weldolets or threadolets manufactured by Bonney Forge. Forged outlets to be used only if branch line is at least one pipe size smaller than main or header.
- C. Fittings 2" and smaller to be threaded, Class 150, standard, malleable iron fittings, with dimensions conforming to ANSI B16.3 and ASTM A-197.
- D. Fittings for galvanized steel pipe to be same as above except have galvanized coating. Fittings for waste, vent, and drainage piping to be drainage pattern type.
- E. Flanges to be Class 150 carbon steel conforming to ASTM A-105 and ANSI B16.5.
- F. Unions to be ASTM A47 malleable iron with bronze-to-iron ground joint rated at 150 lbs. wsp. Threads to conform to ANSI B2.1.
- G. Thread lubricant to be Crane "Formular 425" or equal. Approved Teflon tape may be used at Contractor's option.
- H. Gaskets to be 1/16" thick non-asbestos, ring type (or full face as needed), manufactured by "Klinger" or equal
- I. Fittings to be factory forged in the USA and shall not have been machined, remarked, painted, or otherwise produced domestically from non-domestic forgings.

2.3 COPPER PIPE

- A. Type "L" hard-drawn seamless copper tubing, ASTM B-88:
 - 1. Domestic hot and cold water: all sizes.
 - 2. HVAC chilled water piping 2" and smaller.
 - 3. Air conditioning unit moisture condensate drain pipe – May be used in lieu of galvanized steel pipe.

2.4 COPPER PIPE FITTINGS

- A. Dielectric connection: Provide dielectric couplers at junction of steel pipe and equipment with copper piping systems. Use of steel or cast iron fittings in copper piping systems is prohibited.
- B. Provide sweat fittings, ASTM B-62, dimensions conforming to ANSI B16.22, wrought copper, with sweep patterns for copper tubing. Use lead free solder for piping up to 2-1/2" and silphos for piping 3" and larger.
- C. Unions to be brass ground joint, 250-pound working pressure.
- D. The use of Tee Drill connections is not acceptable.

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2.5 PEX PIPING -

- A. Use crosslinked polyethylene pipe tubing and ASTM F1960 cold expansion fittings.
1. Chilled water piping located in the crawlspace underneath the building.
 2. Standard grade hydrostatic pressure ratings from Plastics Pipe Institute (PPI) in accordance with TR-3 as listed in TR-4. The following three standard-grade hydrostatic ratings are required.
 - (1) 200°F (93°C) at 80 psi (551 kPa)
 - (2) 180°F (82°C) at 100 psi (689 kPa)
 - (3) 73.4°F (23°C) at 160 psi (1,102 kPa)
 3. Certification of flame spread/smoke development rating of 25/50 in accordance with ASTM E84 provided the installation meets one of the following requirements.
 - (1) Tubing spacing is a minimum of 18 inches apart for the following sizes.
 - (a) $\frac{3}{8}$ inch [9.53mm]
 - (b) $\frac{1}{2}$ inch [12.7mm]
 - (c) $\frac{5}{8}$ inch [15.88mm]
 - (d) $\frac{3}{4}$ inch [19.05mm]

PART 3 - EXECUTION

- 3.1 Piping shall be routed approximately as shown on drawings, or as conditions will permit, and shall be so installed as not to interfere with doors and access to equipment. All piping shall be installed so as to run parallel or perpendicular to building lines. Piping shall be installed to allow for expansion as required.
- 3.2 Press connections: Copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- 3.3 Unions, and flanges shall be installed to allow servicing and removal of equipment without dismantling piping. Connections for Owner furnished equipment shall be made with gate valves terminating this Contractor's work.

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- 3.4 Piping shall be hung so that equipment does not bear piping load. Provide additional small piping not shown on drawings required in connection with instruments, gauges, traps, etc. not shown on drawings.
- 3.5 FIRE-RATED PARTITIONS: Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. The firestop system shall have been tested and approved in accordance with ASTM E119 and U.L. 1479 (ASTM E814) and classified for up to 2 hours fire rating. Firestop system shall be type detailed on drawings or intumescent type capable of expanding up to 8 times its original volume. Firestop system to be 3M, Hilti, Nelson, Johns Manville, or Specified Technologies. Firestop system shall be installed in strict accordance with published U.L. approved installation instructions. Piping to pass through the fire-rated partition insulated or non-insulated as specified and detailed. Submit U.L. approved installation drawing for each type of penetration prior to construction.
- 3.6 NON-RATED PARTITIONS: Piping to pass through the walls insulated or non-insulated as specified. Wall should be finished to fit neatly around the piping. Firestopping is not required at non-rated partitions.
- 3.7 PIPE SLEEVES
 1. Pipe sleeves shall be provided at non-rated partitions and floor penetrations. Pipe sleeves to be Schedule 40 or 18 gauge steel. Sleeves to extend 1-1/2" in excess of partition depth on each side. Sleeves penetrating floors in wet areas, including all mechanical rooms, shall extend a minimum of 1 inch above the floor. Piping requiring sleeves:
 - a) Sprinkler (Fire Protection)
 - b) Chilled water
 - c) Copper pipes thru masonry walls
- 3.8 Install isolation valves in each pipe connection to equipment.
- 3.9 Balancing valves shall be installed as shown on the Drawings.
- 3.10 Tees shall be installed to prevent "bullheading". Tees in the same line shall be located a minimum 10 pipe diameters apart.
- 3.11 Pipe dependent on gravity drainage shall be sloped minimum 1/8 inch per foot of horizontal run or as called for on drawings.
- 3.12 Furnish and install dielectric couplings for piping connections of dissimilar metals.
- 3.13 Plastic and cast iron piping and fittings shall not be pressure tested with compressed air. Obtain and follow the manufacturer's recommendations for testing.
- 3.14 Pipes not to be hung or supported by pumps. No torque to be applied to pumps by connecting pipes. After final pipe adjustments and initial operation of the pumps, this Contractor to recheck alignment of pumps and realign as required.

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- 3.15 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS: Refer to drawings. No water piping permitted in transformer, electrical, or elevator equipment rooms.
- 3.16 AIR VENTING: Provide manual air vents at high points of vertical risers and at each water coil to eliminate air from HVAC water systems.
- 3.17 WATER DRAINING: Provide 3/4" hose end gate valves at low points and bottom of each riser to drain HVAC water systems.
- 3.18 Ream pipe after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods of open end closure.
- 3.19 Threads to be right-hand, pipe standard, clean cut, full depth, and tapered. Joints to be made tight without caulking. Approved pipe joint lubricant to be used, applied in thin layer to the male thread only.
- 3.20 Install copper fittings with suitable flux and 95/5 solder. Type K copper pipe to be joined by means of suitable flux and silver or phos-copper.
- 3.21 CONTROL SYSTEM CONNECTORS: Weld 1" steel half coupling Crane No. 386 or equal, or provide 1" female pipe thread connection at points shown on drawings and at necessary points for installation of thermometers and automatic controls.

END OF SECTION

SECTION 23-2114
HYDRONIC PIPING VALVES

PART 1 - GENERAL

1.1 ACCEPTABLE MANUFACTURERS

A. Valves shall be Nibco, Crane, Apollo or approved equal.

1.2 REQUIREMENTS

A. Valves are only required to be insulated in humidified facilities (Hospitals, ASC's).

B. Provide clamp lock hand lever operators on valves less than 6 inches. Provide hand wheel and closed housing worm gear on valves 6 inches and larger unless indicated otherwise below. Provide chain operators for all equipment room and powerhouse valves 4 inch and larger which are located over 6 feet 6 inches above the finish floor. All valves shall be of the extended neck design to allow for the installation of full thickness insulation over flanges. Provide rubber end caps on all exposed valve stems under 7'-0" to prevent bump hazards. Valves shall be installed upright with no more than 45 degrees off center.

PART 2 - PRODUCTS

2.1 GATE VALVES

A. Provide gate valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Chilled Water	2" & smaller	T124 (threaded) / S134 (soldered)	125/150
Chilled Water	2-1/2" & larger	F617-0	125

2.2 BALL VALVES

A. Provide ball valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL</u>	<u>PRESSURE CLASS</u>
Chilled Water	2-1/2" & smaller	T585-70 (threaded) / S585-70 (soldered)	150# CWP

B. Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. A protective sleeve shall be provided that

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allows operation of the valve without breaking the vapor seal or disturbing the insulation. Include fully adjustable memory stops for all ball valves.

2.3 BUTTERFLY VALVES

A. Provide butterfly valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL # / VICTAULIC STYLE #</u>	<u>PRESSURE CLASS</u>
Chilled Water	2-1/2" to 6"	LD2000-3	200
Chilled Water	8" & larger	LD2000-5	200

B. Valves 8" and larger shall have weatherproofed sealed gear operator consisting of fully enclosed worm, worm gear, and worm shaft with hand wheel to provide necessary torque for close-off and infinite throttling positions. Valves 6" and smaller to have 10 position lever lock handle suitable for on-off and manual throttling service. All operators to have valve position indicator and memory stop.

2.4 GLOBE VALVES

A. Provide globe valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Chilled Water	2" & smaller	T-211-Y (threaded) / S-211-Y (solder)	125
Chilled Water	2-1/2" & larger	F718-B	125

2.5 CHECK VALVES

A. Provide check valves per the following table:

<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #</u>	<u>PRESSURE CLASS</u>
Chilled Water	2" & smaller	T-413-Y (threaded) / S-413-Y (solder)	125
Chilled Water	2-1/2" & larger	F-918-B	125

2.6 FLOW BALANCING VALVES

A. Provide flow balancing valves per the following table:

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<u>SERVICE</u>	<u>SIZE</u>	<u>NIBCO MODEL #/</u>	<u>PRESSURE CLASS</u>
Chilled Water	½" to 2"	T-1710 (threaded) / S-1710 (solder)	125
Chilled Water	2" to 12"	F-737	125

- B. Provide valve with memory stop, capped differential pressure readout ports with internal check valves and performed insulation.

2.7 PLUG VALVES

- A. Plug valves shall be lubricated cylindrical plug valves constructed of ASTM A-126, grade B semi-steel and rated for 150 psig working pressure. Square head shall move from fully opened to fully closed with quarter turn of plug. Plug shall float in lubricant. Teflon head seat gasket shall be backed by lubricant reservoir. Valves 2" and smaller shall have screwed ends, 2-1/2" and larger to be flanged. Provide one wrench per valve size and mount on rack in equipment room. Homestead #611 for valves 2" and smaller, Homestead #612 for valves 2-1/2" through 6", Homestead #612-GW for valves 8" and larger. Valves to be factory pre-lubricated with Homestead #204. Provide two high pressure lubricant guns with 17-1/2" long extension hose equivalent to Homestead Type "B" and two cartons of Homestead #204 gun stick lubricant suited for clean water service between minus 30 degrees F and 400 degrees F. Wall mount lubricant guns on a red colored painted wood panel and locate panel in main equipment room near pumps.

2.8 GAS SHUTOFF VALVES

- A. Shutoff valves shall be provided at each piece of equipment and shall be Class 125 gas line cocks with cast iron body, bronze plug and washer, and iron nut, Crane Figure 324.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The installation of butterfly valves in water piping systems shall allow for ordinary maintenance work to be performed on the equipment these butterfly valves isolate, without having to drain the system beyond the butterfly valve. For instance, a check valve, of the type which would have to be removed from the line to replace the clapper or liner, should not be bolted onto a water type butterfly valve since removal of the check valve from the line would involve removing the butterfly valve also.
- B. Valves shall be located so as to be accessible by maintenance personnel. Valves 2 1/2 and larger shall have piping supported on each side of the valve.
- C. Valves shall be installed with stem no longer than horizontal position. Prior to installation valves shall be thoroughly cleaned to remove foreign material.

END OF SECTION

SECTION 23-2115
HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compression Tank.
- B. Tank Air Control Fittings.
- C. Tangential air separator.
- D. Suction diffuser.
- E. P.T. test plugs.
- F. Pressure/Temperature test kit.
- G. Pressure gauges.
- H. Thermometers.
- I. Thermometer test wells.
- J. Relief valves.
- K. Triple-duty valves.
- L. Flow balancing valve.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bell and Gossett ITT
- B. Taco
- C. Armstrong Pumps

2.2 EQUIPMENT

A. Compression Tank

- 1. Tanks to be constructed of carbon steel in accordance with ASME Boiler and Pressure vessel code.
- 2. Tank to be constructed and ASME stamped for 125 psi working pressure at 375 degrees F.
- 3. Unit shall be stamped with ASME "U" symbol.
- 4. Provide tanks with mounting saddles.

B. Tank Air Control Fittings

- 1. Furnish an air control tank fitting containing an air separating trap and water control baffle to provide unrestricted airflow to the compression tank and air-free water flow from the tank.
- 2. Fittings to be equipped with manual vent tube.
- 3. Construct fitting for 125 psi working pressure at 240 degrees F.

C. Tangential Air Separator:

- 1. Provide an external air separation unit consisting of a steel tank, strainer, and collector tube.
- 2. Unit to have flanged tangential inlet and outlet connections.
- 3. Design internal perforated stainless air collector tube to direct released air into compression tank.
- 4. Removable stainless steel system strainer to have 3/16 inch diameter perforations and free area of not less than five times cross-sectional area of connecting pipe.
- 5. Construct unit in accordance with ASME Boiler and Pressure Vessel Code and stamp for 125 psig working pressure at 350 degrees F.
- 6. Unit shall be stamped with ASME "U" symbol.
- 7. Provide blowdown connection on bottom of unit to facilitate routine cleaning of unit.

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8. Unit to prevent accumulation of air in hydraulic heating and/or cooling system and prevent noises caused by entrained air in piping.

D. Suction Diffuser:

1. Provide at each end-suction pump a Suction Diffuser with integral strainer.
2. Unit to consist of cast iron, angle type body with steel inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16 inch diameter openings for pump protection.
3. Equip orifice cylinder with a disposable, fine mesh strainer which shall be removed after system start-up.
4. Design orifice cylinder to withstand pressure differential equal to pump shutoff head and have a free area equal to five times cross-sectional area of pump suction opening.
5. Vane length to be not less than 2-1/2 times the pump connection diameter.
6. Suction diffuser shall be provided with bottom blowdown connection, inlet gauge port, and adjustable support foot to carry weight of suction piping.
7. Suction diffuser to be constructed for 125 psi working pressure.
8. Suction diffusers to be manufactured by Bell & Gossett ITT, Taco, Mueller, or approved equal.

E. P.T. Test Plugs:

1. Provide 1/4 inch solid brass pressure/temperature test plugs at locations shown on drawings.
2. Nordel self-closing valve to be rated for 275 degrees F. service.
3. Plugs to be manufactured by Flow Design, Peterson Engineering, SISCO, or approved equal.

F. Pressure/Temperature Test Kit:

1. Provide Owner complete portable pressure and temperature test kit.
2. Kit to be complete with pressure test gauge, necessary connector hoses, temperature test thermometer with adapter, shutoff and vent valves and carrying case.
3. Readout kit to be manufactured by Bell & Gossett ITT or approved equal.

I. Pressure Gauges:

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1. Provide 3-1/2 inch dial, liquid filled pressure gauges at locations shown on drawings.
 2. Gauges to be equal to Trerice Model No. 800LF with glycerin liquid fill, nylon, steel, or aluminum case, acrylic plastic window, brass movement, phosphor bronze bourdon tube, and brass socket.
 3. Accuracy to be guaranteed within one-half percent in powerhouse and mechanical rooms, other gauges shall be 2% over middle half of scale range and 3% for remainder.
 4. Select scale range of gauges to indicate design pressure near midpoint of scale.
 5. Provide each gauge with 1/4 inch size, brass construction needle valve equal to Trerice Model No. 735-2.
 6. Provide each gauge with impulse dampener equal to Trerice Model No. 870.
- J. Thermometers:
1. Provide Trerice or equal 9-inch scale, adjustable angle (rear, front, and side), industrial thermometers at locations shown on drawings.
 2. Each thermometer to have aluminum case, clear acrylic plastic window, mercury tubing, scale with white background and black markings, brass stem, and separable brass well with 2-1/2" extension neck.
- K. Thermometer Wells:
1. Provide Trerice or equal stainless steel thermometer wells for water temperature sensors and at other locations shown on drawings.
 2. Test wells to be stainless steel with 2-1/2 inch extension neck and screw plug cap with chain and shall be filled with light clear oil.
- L. Relief Valves:
1. Provide relief valves for each hydronic system as shown on drawings.
 2. Valve to be constructed to ASME code requirements, tested by National Board, and labeled with ASME symbol.
 3. Valve body to be bronze construction.
 4. Valves to be diaphragm type operating with slow opening and closing feature.
 5. Valve to seat against face of EPDM rubber.

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6. Set differential between opening and closing pressure to prevent water flash and water hammer.
 7. Valve to include manual lever for testing valve.
- N. Triple-Duty Valves:
1. Provide triple-duty valves in lieu of separate check valve, plug balancing valve, and butterfly shutoff valve as shown on the plans. Triple duty valve to incorporate non-slam, vertical lift check, calibrated balance, and positive shutoff, all in one valve.
 2. Valve to be cast-iron body construction, suitable for maximum working pressure of 125 psig at 250 degrees F.
- N, Flow Balancing Valve:
1. Balancing/shut-off valve to be ball type with bronze/brass, chromium plated bronze ball, Teflon seats, blowout proof stem with Teflon packing and nut, and full size quarter turn handle with grip and memory stop.
 2. The flow measuring element shall be a low loss/high signal Venturi type of one to ten rangeability equipped with dual Schrader type pressure test ports and caps for connection to a portable differential pressure meter.
 3. Meter connections to have built-in check valves.
 4. Valves to provide for leak tight shutoff service at full rated working pressure.
 5. Sizes ½" through 2" to be threaded ends with brass adapters; sizes 2-1/2" and larger to be flanged.
 6. Valves and Venturis to be rated for 125 psig working pressure at 250 degrees F.
 7. Combination flow measuring, balancing, and shutoff valves to be Flow Design or approved equal Venturi type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install hydronic specialties in strict accordance with manufacturers' published installation instructions.
- B. Provide ½" manual air vents at top of pipe risers and other locations where air can be trapped or collected.

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- C. Provide 3/4" hose end gate valve drains at bottom of pipe risers and other locations to drain water systems.
- D. Pipe relief valve outlets from hydronic systems to nearest floor drain.
- E. Support pump inlet and strainer fittings with floor mounted pipe and flange supports.
- F. Locate thermometers and pressure gauges no higher than 7 feet above finished floor elevation.

END OF SECTION

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SECTION 23-2123.13
INLINE CENTRIFUGAL HYDRONIC PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of HVAC pumps work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of pumps specified in this section include the following:
 - 1. In-Line Circulator
- C. Pumps shall be UL certified.

1.2 ACCEPTABLE MANUFACTURERS

- A. Armstrong Pumps
- B. Taco, Inc.
- C. Bell and Gossett, ITT Fluid Handling

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide factory-tested split coupled in-line single stage pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump is listed in pump schedule. Provide pumps of same type by same manufacturer.
- B. Pumps to be configured for the vertical position of the motor up and shall be capable of being serviced without disturbing piping connections.

2.2 REQUIREMENTS

- A. General: Provide in-line circulator pumps where indicated, and of capacities as scheduled. The pump shall be rated for continuous operation at a minimum of 175 psi working pressure and 250 deg F.
- B. Pump volute to be constructed of Class 30 cast iron. It shall be designed with a base ring matching an ANSI 125# flange for pump support. The impeller shall be constructed of cast bronze, enclosed type, balanced to Hydraulic Institute Standards.
- C. Shaft: Hardened alloy steel.
- D. Bearings: Oil-lubricated bronze journal bearings.

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- E. Seal: Mechanical, with carbon seal ring and ceramic seat.
- F. Motor: Non-overloading at any point on pump curve, open, drip-proof, oil-lubricated journal bearings, resilient mounted construction, built-in thermal overload protection on single phase motors. The motor shall be energy efficient EPACT complying to NEMA or IEC specifications. Motors used with variable frequency drives shall be drive rated.

PART 3 - EXECUTION

3.1 INSTALLATION OF PUMPS:

- A. General: Install HVAC pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that HVAC pumps comply with requirements and serve intended purposes.
- B. Access: Provide access space around HVAC pumps for service as indicated, but in no case less than that recommended by manufacturer.
- C. Install in-line pumps, supported independent from piping system.
- D. Piping Connections: Refer to Division-23 HVAC piping sections. Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated.

3.2 ADJUSTING AND CLEANING:

- A. Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

END OF SECTION

END SUCTION, CENTRIFUGAL HYDRONIC PUMPS 23-2123.26-1
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SECTION 23-2123.26
END SUCTION, CENTRIFUGAL HYDRONIC PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of HVAC pumps work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of pumps specified in this section include the following:
 - 1. Frame-Mounted End Suction
- C. Pumps furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.
- D. Pumps shall be UL certified.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

- A. Provide factory-tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump are listed in pump schedule. Provide pumps of same type by same manufacturer.
- B. Pump should be designed to allow for true back pull-out allowing access to the pump's working components, without disturbing motor or piping, for ease of maintenance.
- C. Type: Single stage, flexible coupling, base mounted, designed for 175 psi working pressure.
- D. Casing: Cast iron, 125psi ANSI flanges, tappings for gauge and drain connections. Volute shall include gauge ports at nozzles, and vent and drain ports.
- E. Shaft: Steel with replaceable shaft sleeve.
- F. Bearings: Greasable ball bearings.
- G. Seal: Mechanical, with carbon seal ring and ceramic seat.
- H. Motor: Open, drip-proof, greasable ball bearings. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned, and shall be realigned after installation by the manufacturer's representative. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EPACT 92. Motors used with variable frequency drives shall be drive rated.

END SUCTION, CENTRIFUGAL HYDRONIC PUMPS 23-2123.26-2

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- I. Impeller: Cast Bronze, closed type, hydraulically and dynamically balanced, keyed to shaft and secured with locking screw.
- J. Baseplate: Structural steel with welded cross members, and open grouting area.
- K. Coupling: Flexible, capable of absorbing torsional vibration, equipped with coupling guard.
- L. Manufacturer: Subject to compliance with requirements, provide frame-mounted end suction pumps of one of the following or equal:
 - 1. Armstrong Pumps, Inc.
 - 2. Bell & Gossett ITT; Fluid Handling Div.
 - 3. Taco, Inc.
- M. A center drop-out type coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor. Pumps for variable speed application shall be provided with a suitable coupler sleeve. Coupler shall allow for removal of pump's wetted end without disturbing pump volute or movement of the pump's motor and electrical connections. On variable speed applications the coupler sleeve should be constructed of an EPDM material to maximize performance life.

PART 3 - EXECUTION

3.1 INSTALLATION OF PUMPS:

- A. General: Install HVAC pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that HVAC pumps comply with requirements and serve intended purposes.
- B. Install pressure switches in all systems in which flow must be proven prior to equipment being started.
- C. Access: Provide access space around HVAC pumps for service as indicated, but in no case less than that recommended by manufacturer.
- D. Support: Install base-mounted pumps on minimum of 4" high concrete base equal or greater than 3 times total weight of pump and motor, with anchor bolts poured in place. Set and level pump, grout under pump base with non-shrink grout.
- E. Piping Connections: Refer to Division-23 HVAC piping sections. Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated.

3.2 ADJUSTING AND CLEANING:

- A. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.

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- B. Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23-2300
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-23 HVAC Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of refrigerant piping work is indicated on drawings and schedules, and by requirements of this section.
- B. Insulation of refrigerant piping is specified in other Division-23 sections, and is included as work of this section.

1.3 CODES AND STANDARDS:

- A. ANSI Compliance: Fabricate and install refrigerant piping in accordance with ANSI B31.5 "Refrigeration Piping", and extend applicable lower pressure limits to pressures below 15 psig.
- B. ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS:

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPES AND PIPE FITTINGS:

- A. General: Provide pipes and pipe fittings complying with Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:

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- B. Tube Size 3" and Smaller: Copper tube, Type L, hard-drawn temper; wrought-copper, solder-joint fittings; brazed joints.
- C. Tube Size 1-1/8" and Smaller: Copper tube; Type ACR, soft annealed temper fittings; cast copper-alloy fittings for flared copper tubes; flared joints.
- D. Soldered Joints: Solder joints using silver-lead solder, ASTM B 32, Grade 96 TS.
- E. Brazed Joints: Braze joints using American Welding Society (AWS) classification BCuP-4 for brazing filler metal.

2.3 BASIC PIPING SPECIALTIES:

- A. General: Provide specialties complying with the following listing:
 - 1. Pipe escutcheons.
 - 2. Drip pans.
 - 3. Sleeves.
 - 4. Sleeve seals.

2.4 BASIC SUPPORTS AND ANCHORS:

- A. General: Provide supports and anchors in accordance with the following listing:
- B. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.
- C. Two-bolt riser clamps for vertical piping supports.
- D. Concrete inserts, C-clamps, and steel brackets for building attachments.
- E. Protection shields for insulated piping support in hangers.
- F. Copper flashings for piping penetrations.

2.5 SPECIAL REFRIGERANT VALVES:

- A. General: Special valves required for refrigerant piping include the following types:
 - 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 deg. F (121 deg. C) temperature rating, 400 psi working pressure.
- B. Manufacturer: Subject to compliance with requirements, provide solenoid valves of one of the following or equal:
 - 1. Alco Controls Div.; Emerson Electric Co.
 - 2. Automatic Switch Co.
 - 3. Sporlan Valve Co.

2.6 REFRIGERANT SPECIALTIES:

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- A. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL-listed, 350 psi working pressure.
- B. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-listed, 200 deg. F (93 deg. C) temperature rating, 500 psi working pressure.
- C. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
- D. Manufacturer: Subject to compliance with requirements, provide refrigeration accessories of one of the following or equal:
 - 1. Alco Controls Div.; Emerson Electric Co.
 - 2. Henry Valve Co.
 - 3. Parker-Hannifin Corp.; Refrigeration & Air-Conditioning Div.
 - 4. Sporlan Valve Co.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. General: Examine areas and conditions under which refrigerant piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF REFRIGERANT PIPING:

- A. General: Install refrigerant piping in accordance with Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", and in compliance with equipment manufacturer's recommendations.
- B. Install refrigerant piping with 1/4" per foot (1%) downward slope in direction of oil return to compressor. Provide oil traps and double risers where indicated, and where required to provide oil return.
- C. Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.
- D. Bleed dry nitrogen through refrigerant piping during brazing operations.

3.3 INSTALLATION OF SPECIAL REFRIGERANT VALVES:

- A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions. Remove accessible internal parts before soldering or brazing, replace after joints are completed.
- B. Solenoid Valves: Install in refrigerant piping as indicated with stem pointing upwards.

3.4 INSTALLATION OF REFRIGERANT ACCESSORIES:

- A. Refrigerant Strainers: Install in refrigerant lines as indicated, and in accessible location for service.
- B. Moisture-Liquid Indicators: Install as indicated on refrigerant liquid lines, in accessible location.
- C. Refrigerant Filter-Dryers: Install in refrigerant lines as indicated, and in accessible location for service.

3.5 EQUIPMENT CONNECTIONS:

- A. General: Connect refrigerant piping to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.6 FIELD QUALITY CONTROL:

- A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum, and then 200 psi using halide torch. System must be entirely leak-free.
- B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

3.7 DEHYDRATION AND CHARGING SYSTEM:

- A. Install core in filter dryer after leak test but before evacuation.
- B. Evacuate refrigerant system with vacuum pump; until temperature of 35 deg. F (2 deg. C) is indicated on vacuum dehydration indicator.
- C. During evacuation, apply heat to pockets, elbows, and low spots in piping.
- D. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
- E. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.
- F. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

3.8 ADJUSTING AND CLEANING:

- A. Cleaning and Inspecting: Clean and inspect refrigerant piping systems in accordance with requirements of Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".

END OF SECTION

SECTION 23-2500
WATER TREATMENT (HVAC SYSTEMS)

PART 1 - GENERAL

1.1 SCOPE

- A. Provide a water treatment program for all cooling towers, closed hot and chilled systems, and steam boilers.

1.2 QUALIFICATIONS

- A. Chemicals, service and equipment shall be supplied by a single water treatment company for undivided responsibility. The water treatment chemical and service supplier shall be a recognized specialist, active in the field of industrial water treatment for at least 10 years, whose major business is in the field of water treatment. The water treatment company shall have regional water analysis laboratories, development facilities and service department, plus full time personnel located within the trading area of the jobsite, such as Kesco, Dearborn, Betz or equivalent.

PART 2 - PRODUCTS

2.1 CLOSED SYSTEMS

- A. Chilled, Hot, and Loop Water re-circulating Systems
 - 1. Equipment: Provide one 5-gallon bypass chemical feeder for each system.
 - 2. Chemical: Furnish start-up supply of closed system corrosion inhibitor of the non-chromate type as manufactured by Kesco, Dearborn, Betz or equivalent.

PART 3 - EXECUTION

3.1 CLEANING AND FLUSHING

- A. Thoroughly flush and chemically clean all boilers, condenser, chilled and heated water lines and related equipment. The chemicals shall be designed to remove deposition from construction such as pipe dope, oils, most loose mill scale, and other extraneous materials. Add recommended dosages of chemicals and circulate for a period of 24-48 hours. System shall be then drained and flushed until the total alkalinity of rinse water is equal to the make-up water.
- B. Refill with clean water, properly treated to prevent scale and corrosion.

3.2 WATER MANAGEMENT PROGRAM

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- A. Provide an initial water analysis and recommendations, system start-up assistance, training of operating personnel, all performed by a qualified full-time local representative.

END OF SECTION

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SECTION 23-3113.23
LOW PRESSURE SHEETMETAL DUCTWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Low pressure ductwork refers to systems operating at 2.00" w.g. total static pressure with velocities up to 2000 FPM. It is the intent of this specification to provide an installed duct system which will supply the air quantities indicated by the plans and has the lowest possible friction loss with the least possible leakage loss. Friction loss for each system shall not exceed that which is indicated in the A.C. unit schedule as external static pressure or in the fan schedule as static pressure and shall include the losses of all accessories. Friction losses shall be minimized by reduction in the number of offsets and elbows by pre-planning the duct system installation and coordination with other trades to prevent interferences. Access to all accessories requiring maintenance, service and inspection shall be maintained. Radius elbows are preferred for all turns to minimize friction, noise and vibration; and, especially, for sections having large volume or higher velocities and sections which may have turbulences.
- B. The contractor shall provide and/or construct all materials, ductwork, joints, transitions, splitters, dampers, access doors, etc., as set forth in these specifications necessary to install the Low Pressure Sheet Metal Ductwork required by the Mechanical Drawings.

1.2 QUALITY ASSURANCE

- A. Sheet metal work shall be fabricated and installed in accordance with the most recent recommendations of the SMACNA Duct Manual. When local authorities or specifications included herein are more stringent, they shall supersede the SMACNA guidelines.
- B. Dimensions for sheet metal work shown on Drawings are inside clear unless otherwise noted.
- C. Quality control involves not only the general performance requirements for all air ducts, but also quality workmanship which includes layout preplanning so that offsets, rises, falls, elbows, fittings, etc., are minimized or eliminated. General performance requirements for all ducts include:
 - 1. Dimensional stability (shape deformation and strength).
 - 2. Containment of the air being conveyed (leakage control).
 - 3. Vibration (fatigue and appearance).
 - 4. Noise (generation, transmission or attenuation).
 - 5. Exposure (to damage, weather, temperature extremes, flexure cycles, wind, corrosive atmospheres, biological contamination, flow interruption or reversal, underground or other encasement conditions, combustion, or other in-service conditions).
 - 6. Support (alignment and position retention).
 - 7. Thermal conductivity (heat gain or loss and condensation control).

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1.3 SUBMITTALS AND SHOP DRAWINGS

- A. Submit material/product data to designer for approval ONLY when it deviates from products specified in Part 2 herein.
- B. The General Contractor shall be responsible for coordination between trades. Non-critical piping and conduit shall give way to ducts.
- C. Provide grease duct and kitchen hood shop drawings for review of code officials.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Sheet Metal, Angles, Bar Slips, Hangers, and Straps: Galvanized steel.
- B. Screws: Cadmium plated.

2.2 FABRICATION

- A. Provide rectangular or round double wall supply and return ductwork with R5 rigid insulation in between walls made of prime quality galvanized steel sheets, thickness and reinforcement as required by the following schedule, SMACNA, or local and state codes, whichever is more stringent. When fabricating low pressure ductwork, largest duct dimension governs the entire duct and complete joint.
- B. Exhaust duct which is single wall construction shall be constructed of the next thicker gauge duct as shown below except that ducts up to 18 inches can be 26 gauge.
- C. Ductwork shall be of duct flange construction.
- D. Duct gauge shall conform to the following schedule (the larger side governs the duct):

<u>Max. Duct Dimension Inches</u>	<u>Duct Gauge</u>
Up thru 30	26
31-42	24
43-54	24
55-60	22
61-84	22
85-96	20

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Over 60° Angle 20

- D. In addition to the above, supplemental bracing shall be added as necessary to prevent sagging and drumming.
- E. Duct sections and fittings shall be secured with sheet metal screws.
- F. Connections of round duct to rectangular shall be made with spin-in collars.
- G. A duct in which the larger side is less than 18 inches shall have transverse joints at least every eight feet. Ducts 18 inches or over larger side dimension shall have transverse joints, or equivalent supplemental angle reinforcing on 4 foot centers.
- H. Longitudinal joints shall be Pittsburgh lock or grooved seams closed tightly and evenly.
- I. Ductwork over ten inches dimension, either side, shall have sides cross broken.
- J. Duct dimensions shown on drawings indicate inside clear dimensions. Make allowances in sheet metal size for duct requiring internal duct liner to provide "inside clear" dimensions.
- K. Round prefabricated minimum 24 gauge slip joint snaplock duct may be used on low pressure supply, exhaust and return duct 12" diameter and smaller.
- L. Secure duct sections and fittings with sheet metal screws.
- M. Make connections of round duct to rectangular duct using "spin-in" collars.
- N. Do not exceed 1" in 7" of slope for increase-in-area transitions.
- O. Do not exceed 1" in 4" of slope for decrease-in-area transitions; 1" in 7" is preferable.
- P. Do not exceed 30 degrees on the approaching side and 45 degrees on the leaving side for angle of transitions at connections to equipment without the use of approved vanes.
- Q. Provide ells fabricated to one of the following specifications:
 - 1. Unvaned elbow with the throat radius equal to 1 ½ of the width of the duct and with full heel radius.
 - 2. Six inch throat radius with full radius, vanes and full heel radius.
 - 3. Three inch square throat and square heel, with closed-spaced double thickness turning vanes.
- R. Make branch connections and tees in one of the following manners:

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1. Converging radius elbow.
2. Radius tap-in.
3. Square take off with suitable vanes.

2.3 SPECIAL DUCTWORK

- A. Aluminum Ductwork: Where indicated on drawings, provide rectangular sheet metal ducts constructed of aluminum sheets made of aluminum base alloy having not more than .4 percent copper (for corrosion resistance), a minimum tensile strength of 16,000 psi and ability to satisfactorily make a Pittsburgh lock seam. Provide aluminum ductwork of rigidity, class, thickness, and reinforcement equivalent to steel duct as permitted by SMACNA manual pages 1-31 through 1-33 based on static pressure class of 2" w.g. Provide aluminum sheet metal cleaned and free of grease, dirt, scale, and oxidation. Dielectrically isolate aluminum from uncoated steel or copper. See the drawings for ductwork to be constructed of aluminum alloy sheets.
- B. Kitchen Hood Exhaust Duct: 16 gauge black steel sheet with all welded, continuous, liquid tight seams and joints, ground smooth. At Contractors option, Metal-Fab 3G series prefabricated grease duct or approved equal - 0" clearance to combustibles can be substituted. If this product is used, the 2 hour 3M insulation wrap can be omitted.
1. Install cleanout doors in the sides of the duct located at each change of direction and every 12' straight duct run.
 2. Slope duct back toward the hood or an approved cleanout minimum 1/4" per foot.
 3. Duct to meet NFPA-96 material and installation requirements.
 4. Grease duct fire-rated enclosure to be in accordance with Specification Section 15250.
- C. Dishwasher Exhaust Ductwork: Aluminum above the ceiling and stainless steel from ceiling to dishwasher connection. Provide welded, continuous, liquid tight seams and joints, ground smooth. Ductwork shall slope toward dirty side of dishwasher.

2.4 DUCT SEALING

- A. Seal all duct - exhaust, return, supply, etc to SMACNA Seal Class A..
- B. Sealants
1. New Construction - Use solvent based sealers, unless weather conditions do not permit. Hard cast tape may be used as an alternate.

2.5 DUCT PRESSURE TESTING

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- A. The following ductwork shall be tested at a pressure of 2 in.wc. with a maximum allowable leakage as determined using SMACNA Leakage Class 6:
 - 1. Supply ductwork
 - 2. Stairwell pressurization ductwork
 - 3. Low-pressure return and exhaust duct systems greater than 50 equivalent feet in length in healthcare applications.
- B. Prior to performing leak test all duct systems must be complete. This includes access doors, fire/smoke dampers, flexible duct, and branch run-outs exceeding 10 feet in length.
- C. Documentation of leak test witnessed and signed by the general contractor's superintendant shall be submitted to the architect and engineer for approval.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

- A. Ductwork shall be constructed and erected in a workmanlike manner approximately as shown on drawings. Equivalent size duct to that shown on the drawings can be installed to facilitate installation so long as aspect ratio does not exceed 4 to 1 without express consent from the engineer. Ducts shall be straight and smooth on the inside with neatly finished joints, airtight, and shall be free from vibration under all conditions of operation. The internal ends of slip joints shall be made in the direction of air flow. The ducts shall be securely attached to the building construction in an approved manner.
- B. The configuration and sizes of the ductwork shall be as shown on the drawings. Ductwork sizes shown are inside clear and do not include liners.
- C. Strap hangers for low pressure round ductwork 12" and smaller, when used, shall be continuous. Larger ductwork shall be supported using angle iron or unistrut supports connected to the structure using 3/8" threaded rod. The duct shall be secured to the structural portion of the building with approved anchor shields and to the steel structure by means of C-clamps or bolting. Hangers shall be spaced approximately eight feet along the duct. For ducts 60 inches and larger and heavy sections, such as welded duct and sound absorbers, hangers shall be spaced at approximately four foot intervals.
- D. Permanent pitot ports shall be installed in the ductwork on each system, as required for air balancing. Ports shall be 7/16 inch diameter holes, on maximum eight inch centers, at least three to a duct, and shall be closed up with removable plastic plugs. Insulated duct shall be provided with extension collar around port and screwed panel cover with insulation adhered to underside.
- E. Wherever ductwork is connected to fans, air handling unit or other equipment by means of a flexible connection constructed of UL listed 20-ounce fire resistant

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flexible canvas or other approved material. The connection shall be suitable for the pressures at the point of installation.

- F. Counterflashing: Counterflash all ducts where they pierce the roof.
 - G. Insulation: Where drawings and insulating specifications indicate that ducts are to be insulated, make provisions for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. After system balancing is complete, devices should be covered with insulation and marked. Metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished shall be mounted on duct. Straps should always be on the outside of the insulation and rolled 2" larger than the round duct they support and appropriate saddles shall be installed to protect the insulation.
- 3.2 **CLEANING:** Clean ductwork thoroughly to assure all foreign matter, dirt, etc. is removed. For Healthcare projects the following procedures shall be followed:
- A. All duct is to be shipped to the project sealed with plastic to prevent dust/dirt accumulation during shipping and storage.
 - B. All specified pre-filters and final filters will be installed prior to unit startup.
 - C. All return grilles will be covered with filter media before units are started.
 - D. A final set of the specified pre and final filters will be installed for project turnover.
 - E. Contractor will document duct cleanliness during final commissioning to ensure duct is clean.

END OF SECTION

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SECTION 23-3113.26
MEDIUM PRESSURE SHEETMETAL DUCTWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The contractor shall provide and/or construct all materials, ductwork, joints, transformations, fittings, access doors, etc., as set forth in these specifications necessary to install the medium pressure sheet metal ductwork required by the drawings.
- B. Medium pressure - sheet metal ductwork with air velocity greater than 2000 feet per minute and static pressure 6" or less, but greater than 2".
- C. It is the intent of this specification to provide an installed duct system, which will supply the air quantities, indicated by the plans and has the lowest possible friction loss with the least possible leakage loss. Friction loss for each system shall not exceed that which is indicated in the A.C. unit schedule as external static pressure or in the fan schedule as static pressure and shall include the losses of all accessories. Friction losses shall be minimized by reduction in the number of offsets and elbows by pre-planning the duct system installation and coordination with other trades to prevent interferences. Access to all accessories requiring maintenance, service, and inspection shall be maintained. Elbows with a radius of 1.5 x width radius are preferred for all turns to minimize friction, noise and vibration; and, especially, for sections having large volume or higher velocities, and sections which may have turbulences.
- D. Medium pressure ductwork is required from the outlet of AHU to each variable volume terminal box.

1.2 QUALITY ASSURANCE

- A. Sheet metal work shall be fabricated and installed in accordance with the most recent recommendations of the SMACNA Duct Manual. When local authorities or specifications included herein are more stringent, they shall supersede the SMACNA guidelines.
- B. Dimensions for sheet metal work shown on Drawings are inside clear unless otherwise noted.
- C. Quality control involves not only the general performance requirements for all air ducts, but also quality workmanship which includes layout preplanning so that offsets, rises, falls, elbows, fittings, etc., are minimized or eliminated. General performance requirements for all ducts include:
 - 1. Dimensional stability (shape deformation and strength).
 - 2. Containment of the air being conveyed (leakage control).
 - 3. Vibration (fatigue and appearance).
 - 4. Noise (generation, transmission or attenuation).

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5. Exposure (to damage, weather, temperature extremes, flexure cycles, wind, corrosive atmospheres, biological contamination, flow interruption or reversal, underground or other encasement conditions, combustion, or other in-service conditions).
6. Support (alignment and position retention).
7. Thermal conductivity (heat gain or loss and condensation control).

1.3 SUBMITTALS AND SHOP DRAWINGS

- A. Submit material/product data to designer for approval ONLY when it deviates from products specified in Part 2 herein.
- B. The General Contractor shall be responsible for coordination between trades. Non-critical piping and conduit shall give way to ducts.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Sheet Metal, Angles, Bar Slips, Hangers, and Straps: Galvanized steel.
- B. Screws: Cadmium plated.
- C. Joint Sealer: Manufactured by Hardcast, Inc., Two-Stage Sealant Process.
 1. Stage 1: Apply fiber DT tape.
 2. Stage 2: Brush on RTA-50 sealant over fiber tape.

2.2 FABRICATION REQUIREMENTS

- A. Materials, including sealers (after setting), liners, pre-insulated jackets, and flexible ducts shall have a flame spread rating of not over 25 and smoke developed rating of not over 50.
- B. Double wall spiral duct shall be galvanized steel in accordance with ASTM A-653 and A-924. The inner metal wall shall be a solid liner. Fiber glass insulation shall have a maximum conductivity factor (K) of 0.26 BTU-in/hr o ft² o °F at 75°F mean ambient temperature with a minimum R-5. Retaining fabric shall be 0.008 inch thick, 15.6 lb/ft³ density with an air permeability rate of 9.2 ft³/ft² o s.
- C. Saddle taps shall be used wherever possible for branch take-offs except that they cannot exceed 2/3 the diameter of the trunk duct. Male ends of all fittings shall be at least two inches long, beyond the bead, for diameters up to nine inches and four inches long for ten inches diameter and larger.
- D. Joints in round ducts and in round flexible ducts shall be made with MMM EC800 sealer, or equal, by Benjamin Foster or General Adhesive Company. Sealer shall be fire resistive, after setting. (Reference hereinafter to "sealer" shall mean this type sealer). Male ends of joints shall be coated with sealer, the joint assembled and secured with sheetmetal screws, and sealed with two coats of sealer with a

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gauze strip imbedded between coats.

- E. Rectangular duct shall be double wall duct, shall have a minimum R-5 rigid insulation in between walls and have appropriate thickness per SMACNA and shall be built and installed to SMACNA standards for medium pressure duct. Sealer shall be used in making joints as outlined in SMACNA standards for medium pressure duct construction or as described within these specifications.

2.3 DUCT SEALING

A. All Projects:

- 1. Medium-pressure supply duct - Seal all duct joints and seams to a SMACNA SEAL Class A.

B. Sealants:

- 1. Use water based solvents (due to fumes spreading into occupied spaces). Hard cast tape may be used as an alternative.

2.4 FLEXIBLE DUCT

- A. Flexible duct to air distribution terminals shall be Wiremold, Model WCK, OmniAir, Model 1200 Thermaflex or H.K. Porter Company, UL-181 approved, meeting NFPA 90A Standards. Flexible duct shall be rated at 4000 FPM velocity for 10 inches W.C. through 10 inch diameter and 6 inches W.C. 12 inch through 20 inch diameter. Operating temperature range shall be 140 degrees F. (continuous) at maximum rated pressure, 180 degrees F. (continuous) at 2 inches W.C. positive pressure, and -20 degrees to 250 degrees F. (intermittent) at 1/2 inch W.C. positive pressure. Core fabric shall be reinforced aluminum foil/polyester laminate. Exterior facing and vapor barrier shall be aluminum metalized polyester film laminated to glass mesh. Flexible duct using polyester film without aluminum foil or metalized aluminum will not be accepted.
- B. All flexible ducts shall be factory preinsulated with fiberglass insulation. Insulation shall be 1-1/2 inches, 3/4 pound density fiberglass blanket (With a minimum "K" factor of .28 at 75 degrees F.)

2.5 DUCT PRESSURE TESTING

- A. Medium-pressure duct shall be tested at a minimum static of 6 in. wc., with a maximum allowable leakage rate as determined using SMACNA Leakage Class 6 for rectangular duct and Leakage Class 3 for spiral ductwork.
- B. Prior to performing leak test all duct systems must be complete. This includes access doors, fire/smoke dampers, flexible duct, and branch run-outs exceeding 10 feet in length.
- C. Documentation of leak test witnessed and signed by the general contractor's superintendant shall be submitted to the architect and engineer for approval.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Ductwork shall be constructed and erected in a workmanlike manner approximately as shown on drawings. Equivalent size duct to that shown on the drawings can be installed to facilitate installation so long as aspect ratio does not exceed 4 to 1 without express consent from the engineer. Ducts shall be straight and smooth on the inside with neatly finished joints, airtight, and shall be free from vibration under all conditions of operation. The ducts shall be securely attached to the building construction in an approved manner.
- B. Space hangers approximately 8' along the duct for ducts under 60". For ducts 60" and larger and heavier sections, such as welded duct, space hangers at approximately 4' intervals.
- C. Hangers and bracing used with ductwork to be galvanized.
- D. Obstructions shall not be located within ducts.
- E. Provide smooth insulation finish around dampers, access doors, and similar operating devices. Provide metal collar equivalent in depth to insulation thickness.
- F. Provide pitot ports for measuring airflows in each main supply duct downstream of straightest run of main and before first branch takeoff. Form pitot ports by drilling 7/16" holes in the duct, lined up perpendicular to airflow on maximum of 8" centers. Provide minimum of 3 per duct evenly spaced. Plug holes with plastic plugs. Provide access to pitot ports for future re-balancing.
- G. Seal duct joints as follows:
 - 1. Apply sealer to male end of couplings and fittings. After joint is slipped together, place sheet metal screws 3" on center, 1/2" from joint bead. Apply sealer to the outside of the joint extending 1" on each side of the joint bead and covering screw heads. Apply tape immediately over wet sealer.
 - 2. Duct sealer to be specifically formulated for the sealing of high-pressure duct systems. Sealer to be compatible with tape to ensure cure and bond. Flame spread rating of sealer to be less than 25, smoke development rating of sealer to be less than 50. Sealer to be mineral impregnated woven fiber tape and plastic type activator/adhesive as manufactured by Hardcast Inc., or approved equal. Apply joint material in strict accordance with manufacturers' published installation instructions.
- H. Flanged joints to be sealed with neoprene rubber gaskets.
- I. Flexible duct shall not exceed five feet long.

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- J. Flexible duct shall not pass through fire rated partitions. Stop insulation at each side of wall and route metal duct through wall.
 - K. Seal off the insulation jacket at its ends, at joints and over punctures of the vapor barrier jacket with three inches wide pressure sensitive tape. Complete insulation coverage up to the terminals.
- 3.2 **CLEANING:** Clean ductwork thoroughly to assure all foreign matter, dirt, etc. is removed.
- A. All duct is to be shipped to the project sealed with plastic to prevent dust/dirt accumulation during shipping and storage.
 - B. Contractor will document duct cleanliness during final commissioning to ensure duct is clean.

END OF SECTION

SECTION 23-3300
SHEET METAL ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contractor shall provide and install the following equipment as specified herein and in locations shown on drawings.
 - 1. Air distribution registers, grilles, and diffusers.
 - 2. Fire dampers, smoke dampers, and combination fire/smoke dampers.
 - 3. Access doors.
 - 4. Outside air louvers.
 - 5. Flexible ducts.
 - 6. Air mixing devices.
 - 7. Volume control dampers.
 - 8. Backdraft dampers.
 - 9. Air turning devices.

1.2 QUALITY CONTROL

- A. Fire dampers to be UL labeled and conform to NFPA 90A and NFPA 90B.
- B. Air diffusers, grilles, and registers to have rating certified by Air Diffusion Council and tested per ADC Equipment Test Code 1062R2 and ASHRAE Standard 36B-63.
- C. Fire dampers shall meet test requirements of UL 555.
- D. Smoke dampers shall meet test requirements of UL 555S.

1.3 SUBMITTALS

- A. Submit product data to Owner for approval as required by Section 23 01 02.

PART 2 - PRODUCTS

2.1 REGISTERS, GRILLES AND DIFFUSERS

- A. Acceptable manufacturers include Price, Titus, Metalaire, Nailor and Anemostat. (Titus or Price numbers are used.)
 - 1. Sidewall Supply Registers (non-secure locations): Price model 620, aluminum, double deflection, VCS3 opposed blade volume control damper, and powder coat white finish.

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2. Sidewall Supply Registers (secure locations): Price MSRRP, steel, complete with opposed blade volume control damper. Provide baked-on, white enamel finish.
3. Sidewall Return and Exhaust Registers (non-secure locations): Price model 630, aluminum, fixed horizontal deflection, VCS3 opposed blade volume control damper, and powder coat white finish.
4. Sidewall Return and Exhaust Registers (secure locations): Price MSRRP, steel, complete with opposed blade volume control damper. Provide baked-on, white enamel finish.
5. Ceiling Diffusers (non-secure locations): Price model ASPD, aluminum, square plaque face, 24x24 lay-in, and powder coat white finish.
 - (a) Ceiling diffusers may be suitable for lay-in tile installation by mounting it in a factory fabricated, 24" x 24" back pan.
 - (b) Do not use directional diffusers. Diffusers noted on drawings as three-way or two-way blow shall be four-way diffusers with sides blanked off with sheet metal plates installed in the diffuser necks.
 - (c) No screws shall be used in patient room diffusers
 - (d) Ceiling diffusers serving the top floor with a ducted return shall have insulated backs.
6. Ceiling Diffusers for Operating Rooms and Trauma Rooms: Price LFD. Diffusers shall be constructed using a maximum 6 inches tall backpan designed for optimum performance with the diffuser and shall have integral hanger tabs for securing the unit to the overhead structure to prevent falling in case of earthquakes or other ceiling damage. Each unit shall have an integral internal baffle for evenly distributing air over the entire face of the diffuser. Each unit shall have an integral volume damper accessible through the face of the diffuser. The face of the diffuser shall be constructed of 0.040-inch thick aluminum and shall be perforated with 3/32-inch diameter holes on ¼-inch centers and powder coat white finish.
7. Ceiling Diffusers, Exhaust and Return Grilles (secure locations): Price Series model MSRRCD for supply security directional louver faced diffuser suitable for mounting in drywall ceilings with countersunk tamper-proof screws. Exhaust and return shall be model MSRRP suitable for mounting in drywall ceilings with countersunk tamper-proof screws. Diffusers shall have an inner core suitable for producing a four way discharge pattern. Supply diffusers not in rooms served by a single VAV/CAV box (i.e. patient rooms) and return/exhaust grilles shall be furnished with internal opposed blade dampers. All diffusers and grilles shall have 3/16" holes, 14 gauge faceplate and be furnished with square to round connections.
8. Exhaust and Return Registers (non-secure locations): Price model 80, aluminum, 1/2x1/2x1/2 egg-crate, VCS3 opposed blade volume control

damper, and powder coat white finish. Screws in the face of these grilles shall match the finish for surface mount applications.

2.2 FIRE, SMOKE, & COMBINATION FIRE/SMOKE DAMPERS

- A. Dampers shall be UL listed and in compliance with NFPA 90A. Fire dampers for use in walls, ceilings and floors shall be Greenheck, Ruskin, or Leader Industries. See Architectural and/or Mechanical plans for hour rating of floors and/or wall at damper locations. Dampers to be compatible with hour ratings. Do not use dampers with asbestos paper or coating.
- B. Fire dampers to be UL555 static rated curtain style with spring closing for horizontal mounting and weighted-gravity closing for vertical mounting. Dampers to be manufactured by Greenheck, Ruskin, or Leader Industries. All dampers shall be "C" style frames in square and rectangular low pressure supply, return, or exhaust ducts or round, oval, or medium pressure applications and may have no more than zero (0) percent obstruction to air flow. Provide dampers with integral sleeves and mounting angle frames with metal gauges as required by SMACNA and in accordance with UL and NFPA requirements.
- C. Smoke Dampers: Provide smoke dampers with airfoil blades which are classified by UL as Leakage Rated Dampers for Use in Smoke Control Systems under the latest version of U.L. Standard 555S. The leakage rating shall be no higher than leakage class II (10 cfm/sq.ft. at 1" w.g.). Dampers and their operators shall also be qualified under UL 555S to elevated temperature category B (250 degrees F). Each damper assembly shall bear a U.L. label attesting to it classification.
 - 1. Smoke damper operators shall be electric type, to operate on 120 VAC, 60 Hz or pneumatic type, to operate on 0-10 psig instrument air, and shall be of the spring return type such that damper will be closed upon power interruption. Operators shall be mounted outside the air stream.
 - 2. Operators for the smoke dampers shall be installed by the damper manufacturer at the time of damper fabrication. The damper and operator shall be supplied as a single entity, which meets all applicable UL 555S qualifications for both smoke dampers and operators.
- D. Combination Fire/Smoke Dampers: Provide combination fire and smoke dampers with airfoil blades which are 1-1/2 hour rated under U.L. Standard 555 and also qualified under U.L. Standard 555S. Each combination damper shall bear both UL classified labels. Fire protection shall 1-1/2 hour and the leakage rating shall be no higher than Class II at elevated temperature Category B (10cfm/sq.ft.at 1" w.g. and 250 degrees F).
 - 1. Combination fire/smoke dampers shall be of multi-blade construction with metal-to-metal seals.
 - 2. Except as otherwise noted, each combination fire/smoke damper shall include all the features as required for fire dampers and smoke dampers as described above, including:

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- (a) 160 degrees F (minimum) fusible link;
 - (b) Positive lock in closed position (when activated by melting of fusible link);
 - (c) Remote resetting after being closed via smoke device;
 - (d) Factory-furnished sleeve.
- E. Smoke Detection Devices: Provide factory-mounted smoke detectors with fire/smoke or smoke dampers (equal to Ruskin DSDF).
- F. Miscellaneous Materials: Extra fusible links shall be provided as maintenance spare parts. Furnish 5 percent, but not less than 3 of each type and operating characteristic of fusible links used in project.
- G. All dampers shall have suitable access doors in the duct for examination, testing and service of the damper.

2.3 ACCESS DOORS

- A. Greenheck CAD-10, insulated doors, or approved equal located in ductwork, floors, walls, ceiling, or casing for equipment service such as automatic dampers, fire dampers, smoke dampers, humidifiers, entering side of duct coils (entering side only), casing mounted coils (each side), filters (each side), and elsewhere as noted on drawings.
- B. The size of all access doors at all fire, smoke, or combination dampers shall be as follows:

<u>DUCT SIZE</u>	<u>ACCESS DOOR</u>
12" to 20"	12" x 12"
20" to 36"	18" x 18"
36" and above	24" x 24"
Under 12"	Of sufficient size to service equipment or replace fusible line.

- C. Apparatus Casing Access Doors: Prehung door frame assemblies, Venco HF-10, or equal.
- D. Provide reinforced wire glass view windows 12" x 12" in access doors at humidifiers.
- E. Use double panel construction, two sheets of at least 24 gauge galvanized steel with 1" thick insulation between panels.
- F. Mount doors in a rigid frame of at least 22 gauge formed galvanized steel or aluminum.
- G. Use angle iron bracing as required making the door frame a rigid assembly.

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- H. Provide cam lock access doors and provide positive closing, tight sealing and easily operated latches.
- I. Provide latches that permit easy removal of access door while maintaining positive closing and minimum leakage.
- J. Provide sponge rubber gaskets for all doors.

2.4 AIR LOUVERS

- A. Verify size, location, and placement of louvers prior to fabrication; coordinate field measurements and shop drawings and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units.
- B. Preassemble louvers in as large sections as practical.
- C. Exterior Louvers and Screens: Greenheck model ESD-403, drainable blade, or approved equal by Greenheck, Ruskin, Construction Specialties, or Arrow United.
- D. Material: Extruded aluminum with 12 gauge, .081" thick aluminum blades and frame.
- E. Blade angle: At least 37 degrees.
- F. Minimum blade depth: 4"
- G. Provide internally braced, mitered corners with caulking slots.
- H. Provide slideable interlocked mullions with a provision for expansion and contraction and stainless steel or aluminum fasteners.
- I. Design structural supports to carry a wind load of not less than 20 pounds per square foot.
- J. Provide bird screen, 3/4" x .051" expanded flattened aluminum. Screens shall be on the interior side of the louver and shall be removable.
- K. Provide formed metal sills of the same gauge and material as the louver, sized to lap under the louver sill and the outside edge of the wall.
- L. Louver Finish: Mill finish for painting.
- M. Provide louvers with AMCA Certified Ratings Seal for Air Performance and Water Penetration.
- N. Select intake louvers at or below the "Point of Zero Water Penetration".
- O. Do not exceed 0.2" of air pressure drop across louvers.

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- P. Acceptable manufacturers for louvered penthouses are: Ruskin, Airlite, Construction Specialties, Louvers and Dampers, Inc.
- Q. Have finish on louvered penthouses approved by the Owner's Construction Manager.

2.5 FLEXIBLE DUCT

- A. Acceptable manufacturers: Flexmaster Type 3 Insulated or Thermaflex Type M-KC.
- B. Characteristics of flexible duct:
 - 1. Approved as UL-181 Class 1 air duct.
 - 2. Flame spread rating less than 25 and smoke developed rating less than 50.
 - 3. Rated for 10" w.g. positive pressure, 4" w.g. negative pressure, and 4000 fpm air velocity.
 - 4. Tear and puncture resistant reinforced duct fabric mechanically locked together with a corrosive resistant galvanized steel helix.
 - 5. Insulated with minimum 1" thick, ¾ pound density fiberglass insulation with vapor barrier jacket.
- C. Flexible duct is NOT to be used for runouts where it must pass through walls or through smoke or fire partitions. Flexible duct is not to be used in exposed application. Flexible duct lengths shall not exceed 5 feet at each connection.
- D. No bends shall be made in flexible duct with the center line radius less than one and one-half duct diameter.

2.6 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.
- B. Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
- C. Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/4" inch diameter rod in self aligning, universal joint action flanged bushing with set screw.
- D. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inch.
- E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

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- F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.
- H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases or adapters.

2.7 BACKDRAFT DAMPERS

- A. Provide multi-blade, parallel action gravity balanced backdraft dampers of 16 gauge galvanized steel, or extruded aluminum, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.8 AIR TURNING DEVICES

- A. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with push-pull operator strap.
- B. Acoustic Turning Vanes: Where specifically noted, provide acoustic turning vanes constructed of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.

2.9 EXTRACTORS

- A. Provide volume extractors where shown on the drawings. Extractors shall be gang operated parallel blades on one inch centers, and adjustable from side open to full closed. Unless otherwise noted, extractors shall be furnished with manual operators.

2.10 COUNTERBALANCED RELIEF DAMPERS

- A. Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16 gauge aluminum, provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/4" x 16 gauge channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Sheet metal accessories to be installed in locations shown on drawings.

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- B. Installation to be in accordance with manufacturer's published recommendations as well as applicable sections of the SMACNA manual.
- C. Provide all screws, bolts, nuts, inserts, and material required for attaching sheet metal to duct, walls, floors, and ceilings.
- D. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Use splitter dampers only where indicated.
- E. Provide balancing dampers on medium and high pressure systems where indicated.
- F. Provide fire dampers, and/or smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- G. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's Representative.
- H. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- I. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Cover connections to medium and high pressure fans with leaded vinyl sheet, held in place with metal straps.
- J. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated.

3.2 TESTING

- A. Check work for satisfactory installation and performance.
- B. Insure that adequate access does in fact exist for fire and smoke dampers and that damper operator motors are not hindered in operation by proximity to walls or other objects.
- C. Where applicable, check duct connections, access doors, etc. for leakage and condensation and correct conditions found.

END OF SECTION

HIGH PLUME ISOLATION ROOM FANS 23-3416.26-1
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SECTION 23-3416.26
HIGH PLUME ISOLATION ROOM FANS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Contractor shall provide and install equipment of capacities and sizes as shown on drawings and in compliance with details specified herein.

1.2 QUALITY ASSURANCE

- A. All fans shall bear the AMCA Certified Ratings Seal for air performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Greenheck Model Vektor or approved equal.

2.2 GENERAL

- A. Base fan performance at standard conditions (density 0.075 Lb/ft³).
- B. Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
- C. Each fan shall be belt driven.
- D. Fans to be equipped with lifting lugs.
- E. Fan to be coated steel with a minimum of 4 mils of Hi-Pro Polyester Resin. Color to be gray.
- F. Fasteners to be stainless steel.
- G. Fan assembly shall be designed for a minimum of 125 MPH wind loading, without the use of guy wires.

2.3 FAN HOUSING AND OUTLET

- A. Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
- B. Fan housing shall be welded steel with a minimum of 4 mils of Hi-Pro Polyester Resin. No uncoated metal fan parts shall be acceptable.
- C. Fan housings that are fabricated of polypropylene or fiberglass that have lower

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mechanical properties than steel, have rough interior surfaces in which corrosive, hazardous compounds can collect, and / or which chalk and structurally degrade due to the UV component of the sunlight shall not be acceptable.

- D. A high velocity conical discharge nozzle shall be supplied by the fan manufacturer and be designed to efficiently handle an outlet velocity of up to 6000 FPM. Discharge stack caps or hinged covers, impeding exhaust flow shall not be permitted.
- E. Provide housing drain for removal of rain and condensation.
- F. A bolted and gasketed access door shall be supplied in the fan housing allowing for impeller inspection or removal of impeller, shaft and bearings without removal of the fan housing.
- G. Standard finish color to be parchment white.

2.4 FAN IMPELLER

- A. Fan impeller shall be centrifugal, backward inclined, with non-stall characteristics. The impeller shall be electronically balanced both statically and dynamically per AMCA Standard 204.
- B. Fan impeller shall be manufactured of aluminum (AMCA type B spark resistant), fully welded and coated with a minimum of 4 mils of Hi-Pro Polyester resin.

2.5 FAN BYPASS AIR PLENUM

- A. For constant volume systems, the fan shall be connected directly to the exhaust duct without the need of a bypass air plenum.
- B. For variable volume systems, a bypass air plenum shall be provided as shown on drawings. The plenum shall be equipped with a bypass air damper and intake air hood with bird screen for introducing outside air at roof level upstream of the fan.
- C. The plenum shall be constructed of fully welded steel, and coated with a minimum of 4 mils of Hi-Pro Polyester resin, and mounted on roof curb as shown on the project drawings. Plenums that are fabricated of plastics or resins that are combustible and have mechanical properties less than steel shall not be acceptable.
- D. The bypass air plenum shall be mounted on factory fabricated roof curb provided by the fan manufacturer, as shown on the project drawings (see section 2.5)
- E. Fan designs that use inlet flexible connectors that can leak causing loss of lab exhaust shall not be accepted.
- F. Bypass air dampers shall be opposed-blade design, and coated with a minimum of 4 mils of Hi-Pro Polyester resin, electro-statically applied and baked

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- G. A fan isolation damper, either gravity back draft or two position actuated, fabricated of steel or aluminum and coated with minimum 4 mils of Hi-Pro Polyester resin, electro-statically applied and baked, shall be provided as shown on the project documents.
- H. Blower / Plenum vibration isolation shall be limited to neoprene / cork vibration pads.

2.6 FAN MOTORS AND DRIVE

- A. Motors to be premium efficiency, standard NEMA frame, TEFC with a 1.15 service factor. A factory mounted NEMA 3R disconnect switch shall be provided for each fan. Motor maintenance shall be accomplished without fan impeller removal or requiring maintenance personnel to access the contaminated exhaust components. Motors used with variable frequency drives shall be drive rated.
- B. Drive belts and sheaves shall be sized for 150% of the motor horsepower, and shall be readily and easily accessible for service, if required. Drive shall consist of a minimum of two belts under all circumstances.
- C. Shaft to be polished and ground steel.
- D. Fan shaft bearings shall be Air Handling Quality, ball or roller pillow block type and be sized for an L-10 life of no less than 100,000 hours. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
- E. Bearings shall have extended lube lines with Zerk fittings.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which centrifugal fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

- A. Install centrifugal fans where indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to ensure that centrifugal fans comply with requirements and serve intended purposes.
- B. Provide access and service space around and over centrifugal fans as indicated, but in no case less than that recommended by manufacturer.
- C. Provide 4" high concrete pad under floor-mounted centrifugal fans.

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- D. Set centrifugal fans on vibration isolators and fasten in accordance with manufacturer's installation instructions.
- E. Provide flexible connections on inlet and outlet duct connections.

3.3 FIELD QUALITY CONTROL:

- A. Upon completion of installation of centrifugal fans, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be satisfactorily corrected.

END OF SECTION

SECTION 23-3423
POWER ROOF VENTILATORS AND EXHAUSTERS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Fans shall bear the AMCA seal and meet existing regulatory noise standards.
- B. Fans shall be UL or ETL listed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fans shall be Penn, Greenheck, Loren Cook, or approved equal.

2.2 REQUIREMENTS

- A. Capacity shall be as shown on drawings.
- B. Fan shall be statically and dynamically balanced at the factory. The motor shall be installed in a totally enclosed weatherproof housing outside of the air system. Electrical characteristics for the motor shall be as shown on the drawings. The unit shall be belt driven with oil resistant belt or direct drive as specified. An adjustable sheave in the motor shall be provided to allow changes in the fan specs for belt drive. Fan motors shall have lifetime lubricated sealed ball bearings. Fan and motor shall be isolated with rubber isolators. Motors used with variable frequency drives shall be drive rated.
- C. Fans shall be furnished with a prefabricated, non-combustible, roof curb. See Section 23 74 43.
- D. A factory wired non-fused disconnect switch shall be located under the hood of the unit.
- E. Backdraft dampers shall be installed in the curb of the unit unless specifically shown otherwise on the drawings.
- F. The entire air outlet of the fan shall be protected by 1/2" x 1/2" aluminum mesh securely installed in place.
- G. A 1/4" static pressure tube with 1/4" IPS loosely fitted pipe cap shall be installed to allow the reading of the inlet suction pressure of the fan.
- H. Provide the following accessories:
 - 1. Provide a roof curb hinge kit with cable restraints to access fan wheel and ductwork.

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2. Provide a variable speed controller for direct drive fans.
3. Provide tie down points with four brackets located on the shroud.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Furnish and install fans on the roof on a curb as shown on the drawings.

END OF SECTION

SECTION 23-3613
VARIABLE/CONSTANT VOLUME BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Variable volume air terminal units to be pressure independent, single duct, DDC control type.
- B. Air terminal unit airflow and sound performance ratings to be certified in accordance with ARI Standard 880.

1.2 ACCEPTABLE MANUFACTURER

- A. Trane Model VCCF or VCEF, Titus, Environmental Technologies

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Terminal units to be pressure independent, to reset air volume within plus or minus 5% of reduced air flow (as determined by the space thermostat) regardless of changes in system air static duct pressure. Devices using CFM limiters are not acceptable.
- B. Internal resistance of terminal shall not exceed that scheduled on drawings when handling maximum cataloged air volumes.
- C. Maximum room N.C. - due to discharge or radiated sound - not to exceed 30 when terminals are either in throttled or full open position and inlet static pressure ranging from 0.3 to 1.5 " w.g. Sound ratings and measurements to be derived from sound power levels measured in accordance with ASHRAE Standard with reference level of 10-12 watts. Correction of noise excesses shall not constitute additional charges.
- D. Terminals to be complete with factory provided (installed) actuators and accessory controls suitable for electronic operation. Controls to be mounted in easily accessible enclosure, completely wired requiring only thermostat connection.

2.2 CONSTRUCTION

- A. The outer casing shall be constructed of 22-gage galvanized steel with slip and drive duct connections and hanger holes or brackets.

2.3 INSULATION

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- A. 1" Double-wall Insulation—The interior surface of the unit casing shall be acoustically and thermally lined with a 1-inch, 1.0 lb./ft³ composite density glass fiber with high-density facing. The insulation R-value shall be a minimum of 3.8. The insulation shall be UL listed and shall meet NFPA-90A and UL 181 standards. The insulation shall be covered by an interior liner made of 26-gage galvanized steel. All wire penetrations are covered by grommets.

2.4 PRIMARY AIR VALVE

- A. Air Valve Round—The primary air inlet connection shall be an 18-gage galvanized steel cylinder sized to fit standard round duct. A multiple-point, averaging flow sensing ring shall be provided with balancing taps for measuring +/-5% of unit cataloged airflow. An airflow-versus-pressure differential calibration chart shall be provided. The damper blade shall be constructed of a closed-cell foam seal that is mechanically locked between two 22-gage galvanized steel disks. At 4.0 in. w.g., the air valve leakage shall not exceed 1% of cataloged airflow.
- B. Air Valve Rectangular—The inlet collar shall be constructed of 22-gage galvanized steel sized to fit standard rectangular duct. An integral multiple-point, averaging flow-sensing ring shall provide primary airflow measurement within +/- 5% of unit cataloged airflow. The damper shall be constructed of 22-gage galvanized steel. At 3.0 in. w.g., the air valve leakage shall not exceed 6% of maximum airflow.

2.5 ELECTRIC COILS

- A. The electric heater shall be a factory-provided and -installed, UL recognized resistance open-type heater with airflow switch. It shall contain a disc type automatic pilot duty thermal primary cutout and manual reset load carrying thermal secondary device. Heater element material to be constructed of nickel chromium. The heater terminal box shall be provided with 7/8" knockouts for power supply.
- B. The electric heater shall be Pulse Width Modulation or SCR modulating type heater and shall also be factory provided and installed, UL recognized resistance open-type heater with airflow switch. It shall contain a disc type automatic pilot duty thermal primary cutout and manual reset load carrying thermal secondary device. Heater element material to be constructed of nickel chromium. The heater terminal box shall be provided with 7/8" knockouts for power supply.
- C. Provide the following electric heat options:
 - 1. Electric Heat Transformer – Provide a transformer that is an integral component of the heater control panel (dependent on unit load requirements) to provide 24 VAC for controls.

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2. (SCR-Pulse Width)Mercury Contactor – Provide an electric heater 24-volt contactor for use with direct digital control (DDC) or analog electronic controls.
3. Airflow Switch – Provide an airflow switch device designed to disable the heater when the system fan is off.
4. Line Fuse – Provide a safety fuse located in the line of power of the electric heater to prevent power surge damage to the electric heater.
5. Disconnect Switch – Provide a factory-provided door interlocking disconnect switch on the heater control panel that disengages primary voltage to the terminal.

2.6 CONTROLS

- A. Provide a unit mounted DDC controller to be installed in the factory. The unit shall be complete with a 120 volt to 24-volt transformer for Division 26 power connection in the field.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install terminal units where shown on drawings.
- B. Unit to be installed per manufacturer's published recommendations.

END OF SECTION

EXTRUDED ALUMINUM STATIONARY LOUVERS 23-3733-1
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SECTION 23-3733
EXTRUDED ALUMINUM STATIONARY LOUVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Extruded aluminum stationary louvers with drainable blades.

1.2 REFERENCES

- A. AAMA 605.2 - High Performance Organic Coatings on Architectural Extrusions and Panels.
- B. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- C. AMCA 511 - Certified Ratings Program for Air Control Devices.

1.3 QUALITY ASSURANCE

- A. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Ruskin Manufacturing Model ELF375DXH
- B. National Control Air Model XAD-4

2.2 EXTRUDED ALUMINUM STATIONARY LOUVERS

A. Fabrication:

1. Performance Ratings: AMCA licensed.

2. Frame:

- (a) Material: Extruded aluminum, Alloy 6063-T5.
- (b) Wall Thickness: 0.125 inch, nominal.
- (c) Depth: 4 inches.
- (d) Downspouts and caulking surfaces.

3. Blades:

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- (a) Style: Drainable.
- (b) Material: Extruded aluminum, Alloy 6063-T5.
- (c) Wall Thickness: 0.125 inch (3.2 mm), nominal.
- (d) Angle: 37.5 degrees.
- (e) Centers: 5-3/32 inches (129 mm), nominal.

4. Bird Screen:

- (a) Material: Aluminum, 3/4 inch x 0.051 inches, expanded, flattened.
- (b) Frame: Removable, rewireable.

5. Gutters: Drain gutter in head frame and each blade.

6. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.

7. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.

8. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.

9. Assembly: Factory assemble louver components. All welded construction.

B. Performance Data:

- 1. Based on testing 48 inch x 48 inch size unit in accordance with AMCA 500.
- 2. Free Area: 54 percent, nominal.
- 3. Free Area Size: 8.58 square feet.
- 4. Maximum Recommended Air Flow Thru Free Area: 873 feet per minute.
- 5. Maximum Pressure Drop: 0.15 inches w.g.
- 6. Water Penetration: Maximum of 0.01 ounces per square foot of free area at an air flow of 873 feet per minute free area velocity when tested for 15 minutes.

2.3 ACCESSORIES

- A. Blank-Off Panels 1 inch (25 mm), aluminum skin, insulated core, factory installed with removable screws and neoprene gaskets.
- B. Hinged Frame: Continuous piano hinge attached to [angle] [channel] subframe.
- C. Bird Screens
- D. Insect Screens
- E. Extended Sills: Extruded aluminum, Alloy 6063-T5. Minimum nominal wall thickness 0.060 inch (1.5 mm).

2.4 FACTORY FINISH

- A. Standard mill finish.

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- B. Kynar 500 Fluoropolymer Coating:
 - 1. Conform to AAMA 605.2.
 - 2. Apply coating following cleaning and pretreatment.
 - 3. Cleaning: AA-C12C42R1X.
 - 4. Dry louvers before final finish application.
 - 5. Total Dry Film Thickness: Approximately 1.2 mils (0.03 mm), when baked at 450 degrees F (232 degrees C) for 10 minutes.
- C. Prime Coat:
 - 1. Apply alkyd prime coat following chemical cleaning and pretreatment.
 - 2. Primer preparation for field painting.
- D. Color for Fluoropolymer Coating: Color as selected by Architect from manufacturer's standard colors.
- E. Color for Anodize Finish: By architect

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.
- B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

3.3 CLEANING

- A. Clean louver surfaces in accordance with manufacturer's instructions.
- B. Repair minor damaged surfaces as directed by Architect.

END OF SECTION

KITCHEN EXHAUST HOODS & DUCTWORK 23-3813.13-1
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SECTION 23-3813.13
KITCHEN EXHAUST HOODS AND DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.2 CODES AND STANDARDS

- A. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
- B. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
- C. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".

PART 2 - PRODUCTS

2.1 KITCHEN EXHAUST DUCTS

- A. Fabricate kitchen exhaust ducts and supports, used for smoke and vapor removal from cooking equipment, of 16-ga minimum steel where concealed, or 18-ga minimum stainless steel. For duct construction, comply with SMACNA "HVAC Duct Construction Standards", and NFPA 96 "Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment".
- B. Install cleanout doors in the sides of the duct located at each change of direction and every 12' straight duct run.
- C. Slope duct back toward the hood minimum 1" per foot.
- D. Ductwork shall be sized to maintain a minimum of 1500 FPM

2.2 KITCHEN EXHAUST HOODS

- A. Exhaust Only Wall Mounted Hood
 - 1. Unit to be Captive Aire "ND Series" exhaust only hood or approved equal.

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2. Unit construction shall be type 430 stainless steel with a #3 or #4 polish where exposed. All seams, joints and penetrations of the hood enclosure to the lower outermost perimeter that directs and captures grease-laden vapor and exhaust gases shall have a liquid-tight continuous external weld in accordance with NFPA 96. Hood shall be wall type with a minimum of four connections for hanger rods. Connectors shall have 9/16" holes pre-punched in 1 ½" x 1 ½" angle iron at the factory to allow for hanger rod connection by others.
3. Ventilator shall be furnished with U.L. classified aluminum baffle filters, supplied in size and quantity as required by ventilator. The filters shall extend the full length of the hood and the filler panels shall not be more than 6" in width.
4. Exhaust duct collar to be 4" high with 1" flange. Provide a fire damper in the exhaust duct collar.
5. U.L. incandescent light fixtures and globes shall be installed and pre-wired to a junction box. The light fixtures shall be installed with a maximum of 4'0" spacing on center and allow up to a 100 watt standard light bulb.
6. A double wall insulated front to eliminate condensation and increase rigidity. The insulation shall meet UL 181 requirements and be in accordance with NFPA 90A and 90B.
7. An integral front baffle to direct grease laden vapors toward the exhaust filter bank.
8. A built-in wiring chase provided for outlets and electrical controls on the hood face and shall not penetrate the capture area or require an external chaseway.
9. The grease drain system shall be an integral part of the hood back and have a minimum 1/8" per foot slope with an exposed, removable ½ pint grease cup to facilitate cleaning.
10. The hood shall be ETL Listed, NSF Listed, and built in accordance with NFPA 96.

2.3 FIRE SUPPRESSION SYSTEM

- A. Provide an Ansul R-102 Fire Suppression System to serve each kitchen exhaust hood. The system shall be capable of protecting all hazard areas associated with cooking equipment.
- B. The system shall be an automatic fire suppression system using a wet chemical agent for grease related fires. The system shall be capable of suppressing fires in the following areas associated with cooking equipment: ventilating equipment including hoods, ducts, plenums, and filters; fryers; griddles and range tops; upright, natural charcoal, or chain-type broilers; electric, lava rock, mesquite or gas-radiant char-broilers. The system shall be the pre-engineered type having

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minimum and maximum guidelines established by the manufacturer and listed by Underwriters Laboratories, Inc. (UL).

C. Components:

1. The basic system shall consist of an ANSUL AUTOMAN regulated release assembly. This assembly includes a regulated release mechanism and a wet chemical storage tank housed within a single enclosure. Nozzles, blow-off caps, detectors, cartridges, agent, fusible links, and pulley elbows shall be supplied in separate packages in the quantities needed for fire suppression system arrangements. Additional equipment shall include remote manual pull station, mechanical and electrical gas valves, pressure switches, and electrical switches for automatic equipment and gas line shut-off.

D. Wet Chemical Agent

1. The extinguishing agent shall be a specially formulated, aqueous solution of organic salts with a pH range between 7.8 - 8.2, designed for flame knockdown and foam securement of grease related fires.

E. Agent Tank

1. The agent tank shall be installed in a stainless steel enclosure or wall bracket. The tank shall be deep drawn carbon steel finished in red enamel. The tanks shall have a working pressure of 100 psi, a test pressure of 300 psi, and a minimum burst pressure of 600 psi. The tank shall include an adaptor/tube assembly containing a burst disc union.

F. Regulated Release Mechanism

1. The regulated release mechanism shall be a spring-loaded, mechanical/pneumatic type capable of providing the expellant gas supply to one or two agent tanks depending on the capacity of the gas cartridge used. It shall contain a factory installed regulator deadset at 100 psi with an internal relief of approximately 145 psi. It shall have the following actuation capabilities: automatic actuation by a fusible link detection system and remote manual actuation by a mechanical pull station. The regulated release mechanism shall contain a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless steel enclosure with cover. The enclosure shall contain knock-outs for 1/2 in. conduit. The cover shall contain an opening for a visual status indicator. It shall be compatible with mechanical gas shut-off devices; or, when equipped with a field or factory-installed switch, it shall be compatible with electric gas line or appliance shut-off devices.

G. Regulated Actuator Assembly

1. When more than two agent tanks are required, the regulated actuator shall be available to provide expellant gas for additional tanks. It shall be connected to the cartridge receiver outlet of the regulated release mechanism providing simultaneous agent discharge. The regulator shall be

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deadset at 100 psi with an internal relief of approximately 145 psi. The regulated actuator assembly shall contain a regulated actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure shall contain knockouts to permit installation of the expellant gas line.

H. Discharge Nozzles

1. Each discharge nozzle shall be tested and listed with the R-102 system for a specific application. Nozzles tips shall be stamped with the flow number designation (1/2, 1, 2, and 3). Each nozzle shall have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up.

I. Distribution Piping

1. Distribution piping shall be Schedule 40 black iron, chrome-plated, or stainless steel pipe conforming to ASTM A120, A53, or A106.

J. Detectors

1. The detectors shall be the fusible link style designed to separate at a specific temperature.

K. Cartridges

1. The cartridge shall be a sealed steel pressure vessel containing either carbon dioxide or nitrogen gas. The cartridge seal shall be designed to be punctured by the releasing device supplying the required pressure to expel wet chemical agent from the storage tank.

2.4 IMC Interlock

- A. Provide thermostat, junction box, and relay as required to automatically start exhaust fan when heat is detected. The IMC interlock is designed to automatically start kitchen hood exhaust fans and keep them running while heat is being generated from the cooking appliances. Hood systems should always be manually started before equipment is turned on, only if the fans are forgotten to be turned on should the auto on feature be utilized.

PART 3 - EXECUTION

3.1 INSTALLATION OF KITCHEN EXHAUST DUCTS

- A. Fabricate joints and seams with continuous welds for watertight construction. Provide for thermal expansion of ductwork through 2000 deg. F (1093 deg. C) temperature range. Install without dips or traps, which may collect residues, except where traps have continuous or automatic residue removal. Provide access openings at each change in direction, located on sides of duct 1-1/2" minimum from bottom, and fitted with grease-tight covers of same material as duct. The ductwork shall not pass through walls with a fire resistance rating of two hours or more and a clearance of 18 inches or more must be maintained between ducts

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and combustible material. Paint exterior ductwork made of steel to protect against the weather or fabricate of stainless steel.

END OF SECTION

SECTION 23-4113
AIR FILTERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install a complete installation of panel filters and/or high efficiency final filters, in factory-fabricated housing equipped with appropriate draft gauge.

1.2 QUALITY ASSURANCE

- A. Filters must meet NFPA 90A requirements for flammability.

1.3 ACCEPTABLE MANUFACTURERS

- A. Camfil Farr
- B. American Air Filter
- C. Approved Equal

PART 2 - PRODUCTS

2.1 TWO-INCH THICK, DISPOSABLE, 30% EFFICIENT FILTERS

- A. Air filters shall be UL Class 1, medium efficiency, ASHRAE pleated panels consisting of microfiber glass media, all-glass closed-mesh backing, media support grid and enclosing frame.
- B. Filter media shall be microfiber glass laminated to an all-glass mesh backing and formed into uniform radial pleats.
- C. A welded wire grid, spot-welded on one-inch centers and treated for corrosion resistance, shall be bonded to the downstream side of the media to maintain the radial pleat and prevent media oscillation.
- D. An enclosing frame of non-flammable board shall provide a rigid and durable enclosure. The frame shall be bonded to the media to prevent air bypass, and include integral diagonal support members on the air entering and air exiting side to maintain uniform pleat spacing in varying airflows.
- E. The filter shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE Standard 52.2-1999. It shall have an average dust spot efficiency of 25-30% when evaluated under ASHRAE Standard 52.1-1992.
- F. Initial resistance to airflow shall not exceed 0.38" w.g. at an airflow of 500 fpm.

2.2 TWELVE-INCH THICK 90-95% EFFICIENT FINAL FILTERS

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- A. Air filters shall be high-efficiency ASHRAE high lofted supported media disposable type assembled in a compact and secure enclosing frame.
- B. Filter media shall be of microfine glass laminated to a reinforcing backing to form a uniform lofted media blanket.
- C. The media blanket shall be formed into uniform tapered radial pleats and bonded to a stiffened backing that is bonded to the downstream side of the media to preclude media oscillation.
- D. The media shall be mechanically and chemically bonded within the frame to prevent air bypass.
- E. The enclosing frame shall be constructed of corrosion resistant galvanized steel. Media support contour stabilizers shall be mechanically fastened to diagonal support members of the same construction shall create a rigid and durable filter enclosure. There shall be a minimum of four contour stabilizers on the air entering side and four on the air exiting side.
- F. The filter shall have a Minimum Efficiency Reporting Value of MERV 14 when evaluated under the guidelines of ASHRAE Standard 52.2-1999. It shall have an average dust spot efficiency of 90-95% when evaluated under ASHRAE Standard 52.1-1992.
- G. Initial resistance to airflow shall not exceed 0.68" w.g at an airflow of 500 fpm.
- H. The filter shall be capable of withstanding 10" w.g. without failure of the media pack.
- I. Filter shall be rated by Underwriters Laboratories as UL Class 2.

2.3 FILTER GAUGES

- A. Inclined Manometer: One piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0-3 inch WG, 2 percent of full scale accuracy. Provide a filter gauge across all filters.
- B. Accessories: Static pressure tips with integral compression fittings, 1/4 inch aluminum or plastic tubing, 2-way or 3-way vent valves.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide filters in locations as shown on drawings of sizes and capacities as scheduled.
- B. Install filters in accordance with manufacturer's published installation instructions.
- C. Filters shall be installed in frames or apparatus casing so as to be leak free. Verify with light test from both sides.

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- D. Protect heating and/or heating coils with media during construction.
- E. Deliver one complete change of media to the Owner.
- F. Provide insulation as required on filter housing to ensure elimination of sweating.

END OF SECTION

SECTION 23-6213
AIR COOLED CHILLER

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-23 HVAC Basic Mechanical Materials and Methods sections apply to work of this section.
- C. Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Warranty is limited to component replacement only, and does not include labor for removal and reinstallation of parts. All units shall have a minimum compressor replacement warranty of 5 years.

PART 2 - PRODUCTS

2.1 AIR-COOLED UNITS - 5 TONS AND LARGER:

- A. Units shall be Trane, or approved equal, split system factory-assembled and tested air-cooled units, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls. Capacities and electrical characteristics are scheduled on the Drawings.
- B. Unit Casings shall be designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives. The unit casing shall be constructed of zinc coated heavy gauge, galvanized steel.
- C. Compressor shall be scroll hermetic-type compressor, 1,750 RPM, designed for air-cooled condensing, crankcase heater, and back seating service access valves on suction and discharge ports. Capacity shall be controlled through compressor cycling and cylinder unloading.
- D. Operating and safety controls shall include high and low pressure cutouts, oil pressure cutout, compressor winding thermostat cutout, 3-leg compressor overload protection, and condenser fan motors with thermal and overload cutouts. Control transformer if required shall be 115-volts. Provide magnetic contactors for compressor and condenser fan motors.

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- E. Condenser coil shall be seamless copper tubing mechanically bonded to heavy-duty, aluminum fins, with separate and independent refrigeration circuit for each compressor. Units shall include liquid accumulator and sub cooling circuit, and back seating service access valves. Condenser coils shall be factory-tested at 420 psig, vacuum dehydrate, and filled with a holding charge of nitrogen.
- F. Condenser fans and drives: propeller-type condenser fans for vertical air discharge; either direct drive or belt drive.
- G. Accessories
 - 1. Low ambient head pressure control – Shall modulate or cycle the speed of the outdoor unit fan motor in response to outdoor ambient temperature and discharge line pressure. Unit shall be capable for operation down to 0 deg F.
 - 2. Hot gas bypass kit.
 - 3. Time delay relay.
 - 4. Anti-Short-Cycle timer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install condensing units in accordance with manufacturers installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Install ground-mounted units on 4" thick reinforced concrete pad, 4" larger on each side than condensing unit. Concrete is specified in Division 3. Coordinate installation of anchoring devices.
- C. Install roof-mounted units on equipment supports. Anchor unit to supports with removable fasteners.
- D. Connect refrigerant piping to unit; maintain required access to unit.
- E. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.
- F. Start up condensing units in accordance with manufacturer's instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

END OF SECTION

SECTION 23-7313
MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of air handling unit work is indicated on drawings and schedules, and by requirements of this section.
- B. Provide double-wall indoor central station air handling unit.
- C. Provide the following electrical work as work of this section, complying with requirements of Division-26 sections:
 - 1. Control wiring between field-installed controls, indicating devices, and unit control panels.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged air handling units with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. AMCA Compliance: Test and rate air handling units in accordance with AMCA standards.
 - 2. ARI Compliance: Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air Handling Units", display certification symbol on units of certified models.
 - 3. UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA Standards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide air-handling units from one of the following manufacturers:
1. Trane M Series Central Station Air-Handler
 2. Carrier
 3. McQuay
 4. York

2.2 UNIT CONSTRUCTION

A. Casings

1. Construct casings of 18-ga minimum mill galvanized steel, designed to withstand 6 in. w.g. positive or 4 in. w.g. negative operating pressures. Provide casing panels and/or access doors that are easily and quickly removable for inspection and access to internal parts.
2. Provide reinforced points of support for either setting or hanging units.
3. Cover casing and frame with protective finish on both sides.

B. Insulation

1. Double Wall Solid Panels
 - (a) Panels shall be of double-wall construction to facilitate cleaning of the unit interior. The interior wall shall be constructed of solid, galvanized steel. Insulation shall be 1-1/2 lb/c.f. density. The thermal resistance shall be 8.33 ft²-h-deg F / Btu.
2. Insulate unit casing from air entrance to coils, to air outlet from unit, including bypass duct if used. Insulate framing angles exposed to air stream. Securely attach insulation, of sufficient thickness and density to prevent condensation from forming on unit casing. Protect insulation against deterioration from air currents.
3. Provide insulation with fire-retarding characteristics, complying with NFPA 90A. Insulation adhesive shall be UL-listed.

C. Drain Pan

1. Provide drain pan, located under all coil sections, intake modules, of sufficient length to catch condensate leaving coil at highest catalogued face velocity. Provide at least one drain connection at low point in drain pan.
2. The drain pan shall be of double wall, insulated, and stainless steel construction.

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3. The drain pan shall be sloped in two planes to eliminate stagnant water conditions.

D. Access Doors

1. Access doors shall be constructed of double wall, solid, galvanized steel interior panel and a solid galvanized steel exterior panel. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage. Surface mounted handles shall be provided to allow quick access to the interior of the module. Access doors shall be hinged and removable for quick, easy access.

E. Marine Lights

1. Provide a factory mounted, weather resistant, vapor-tight, incandescent light fixture in all access and fan modules. The fixture shall be complete with junction box, globe, aluminum globe guard, receptacle, and bulb.

2.3 FANS

- A. The fan shall be a double width, double inlet, multi-blade type forward curved (FC) or airfoil (AF) type fan. The fan shall be equipped with self-aligning, anti-friction bearings with an L-50 life of 200,000 hours as calculated per ANSI/AFBMA Standard 9. Fan performance shall be certified as complying with ARI standard 430.
- B. The fan shall be a single width, single inlet, multi-blade type plenum fan (PF). The fan shall be backward inclined airfoil. The fans shall be equipped with self-aligning, anti-friction pillow block bearings with an L-50 life of 200,000 hours as calculated per ANSI/AFBMA Standard 9. The plenum fan module shall be provided with an expanded metal guard screen for the access door.
- C. Provide fans specifically designed and suitable for class of service indicated. Provide adjustable motor base, adjusted with mounting bolts, to provide variation in center distance. Provide locking nuts, or similar devices, to secure base in proper position. Provide belt-driven fans with adjustable pitch pulley permitting fan speed to be varied. Select pulley for mid-point of adjustable range. Design fan shafts so as not to pass through first critical speed when unit comes up to rated RPM. Provide grease-lubricated fan bearings with externally accessible fittings for lubrication. Statically and dynamically balance fan assemblies in fan housing after final assembly.
- D. Fan Isolation – Provide 1” or 2” internal spring isolators for the fan assembly, furnished and installed by the unit manufacturer.
- E. Provide the following for fan modulation in variable volume systems:
 1. Variable Frequency Drives – See Section 23 09 14 for requirements.
- F. Fan Motors – The motor shall be integrally mounted to an isolated fan assembly furnished by the unit manufacturer. The motor shall be mounted inside the unit

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casing on an adjustable base to permit adjustment of the drive-belt tension. The motor shall be premium efficiency, T-frame, squirrel cage with size, type, and electrical characteristics as shown on the equipment schedule. The fan motor shall be inverter duty type for use with a variable frequency drive (VFD).

2.4 COILS

A. Coil Modules

1. The coil module shall be provided with coil and coil holding frame. If two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil to drain condensate to the main pan without passing condensate through the air stream of the lower coil.
2. The coils shall be manufactured by the supplier of the air-handling unit. The coils shall be installed such that the headers and return bends are enclosed by unit casings. The coil connections shall be clearly labeled on the unit exterior.

B. Inspection Section

1. The coil module shall include an inspection section complete with a double-wall, removable door downstream of the coil for inspection, cleaning, and maintenance.

C. Water Coils

1. The coils shall have aluminum fins and seamless copper tubes. Copper fins may be applied to coils with 5/8" tubes.
2. The coil casing shall be galvanized OR stainless steel.
3. The coils shall be proof-tested to 300 psig and leak-tested under water to 200 psig.
4. Headers shall be constructed of round copper pipe or cast iron.
5. Provide chilled water and heating coils with threaded connections. Provide chilled water coils with drain and vent connections.

D. Electric Heating Modules

1. The electric heater shall be factory installed in the air-handler.
2. The heater shall be an open-coil configuration with Type A wire derated to a maximum watt density of 45 watts per square inch. Safeties shall include
 - (a) Three pole disconnecting type contactors
 - (b) Airflow switches
 - (c) Automatic reset high-temperature limits
 - (d) Manual reset high-temperature limits
3. Electric heaters above 48 amps shall be fused into circuits not to exceed 48 amps as required by UL and NEC.
4. Controls shall be installed with the proper staging for the voltage and kilowatt specified.

2.5 FILTERS

A. Pleated Media Filters

1. The filters shall be 2-inch made of non-woven fabric, treated with adhesive, and continuously laminated to a supported steel wire grid.
2. The filters shall be capable of operating up to 625 fpm face velocity without loss of filter efficiency and holding capacity.
3. The filters shall have a rated average dust spot efficiency of not less than 30% when tested in accordance with the ASHRAE Standard 52 atmospheric dust spot method.

B. Cartridge Filters

1. The filters shall be constructed with a continuous sheet of fine-fiber media made into closely spaced pleats with safe-edged aluminum separators.
2. The filters shall be capable of operating up to 625-fpm face velocity for 12" deep filters and up to 312 fpm for 6" deep filters with loss of filter efficiency and holding capacity.
3. The filters shall be sealed into a metal frame assembled in a rigid manner. The gasket material shall be installed on the metal header of the filter to prevent filter bypass where the metal headers meet on the side access racks.
4. The manufacturer shall supply a side access filter rack capable of holding cartridge filters and prefilters.
5. The filter efficiency shall be:
 - (a) 90-95% - The efficiency of the filter shall average 90% to 95% as determined by the ASHRAE Standard 52 atmospheric dust spot method.

2.6 MIXING AND BYPASS

- A. **Mixing Boxes:** Provide mixing boxes of physical size to match basic unit, and include equal-sized flange openings capable of handling full airflow. Arrange openings as indicated.
- B. **Economizer Dampers:** Outdoor, return, and exhaust dampers shall be provided as shown on the drawings. The dampers shall be of double skin airfoil design with metal, compressible jamb seals and extruded vinyl blade edge seals on all blades. The blades shall rotate on stainless steel sleeve bearings. The dampers shall be rated for a maximum leakage rate of 5 cfm/s.f. at 1" w.g. and 9 cfm/s.f. at 4" w.g. Dampers may be arranged in a opposed blade configuration.
- C. **Airflow Measurement Station:** Provide a factory mounted piezo ring airflow measurement station in the outdoor and/or return air opening to measure airflow. This device will be connected to a Paragon Microtransducer and shall measure from full unit nominal airflow. The airflow measurement station shall adjust for temperature variations and shall provide a 4 to 20 mA or 0 to 10 Vdc

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signal that corresponds to actual airflow for controlling and documenting airflow. The accuracy of the unit shall be +/- 0.25%.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which air handling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF AIR HANDLING UNITS

- A. General: Install air handling units where indicated, in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.
- B. Coordination: Coordinate with other work, including ductwork, floor construction, roof decking, and piping, as necessary to interface installation of air handling units with other work.
- C. Access: Provide access space around air handling units for service as indicated, but in no case less than that recommended by manufacturer.
- D. Support: Install floor-mounted air handling units on 4" high reinforced concrete pad, 4" larger on each side than unit base.
- E. Support: Install roof-mounted air handling units on structural steel mechanical stand. Anchor unit to stand with removable fasteners.
- F. Mechanical equipment stand is specified in metal supporting division; not work of this section.
- G. Mounting: Mount air-handling units on vibration isolators, in accordance with manufacturer's instructions.
- H. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
- I. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.3 FIELD QUALITY CONTROL:

- A. Testing: Upon completion of installation of air handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

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3.4 EXTRA STOCK:

- A. Provide one complete extra set of filters for each air-handling unit. Install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed.

END OF SECTION

SECTION 23-7443
ROOF CURBS

PART 1 – GENERAL

1.1 INTRODUCTION

- A. This section includes curbs for all roof mounted air moving equipment or appurtenances requiring roof penetrations.

PART 2 - PRODUCTS

2.1 FACTORY INSULATED FAN & DUCT CURBS

- A. Curb shall be equal to Thycurb Model TC-3
- B. Curb Construction
 - 1. Welded 18 gauge galvanized steel shell and base plate
 - 2. 1-1/2" thick 3-pound density rigid insulation
 - 3. Factory installed 2 x 2 wood nailer
 - 4. Reinforcing on sides 36" and greater
 - 5. 12" curb height
 - 6. Provide Kinetics KSMF-1 seismic fan clips and install per manufacturer's instruction

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Furnish and install curbs in accordance with manufacturer's recommendations as shown on drawings.

END OF SECTION

SECTION 23-8123.16
COMPUTER ROOM AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. These specifications describe requirements for an environmental control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment. The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements of the room.

1.2 ACCEPTABLE MANUFACTURERS

- A. Liebert Challenger 3000
- B. Data Aire
- C. Specifically approved equal.

PART 2 - PRODUCTS

2.1 CABINET AND FRAME

- A. The frame shall be constructed of MIG welded tubular and formed steel. All frame components shall be painted with a black powder coat finish for maximum corrosion protection. The exterior panels shall be 20 gauge. The unit shall be insulated with a minimum 1 in., 1.5 lbs. density fiber insulation. The main front panel shall have captive 1/4 turn fasteners.
- B. The cabinet shall be designed so that all components are serviceable and removable from the front of the unit.

2.2 FAN SECTION

- A. The fans shall be the centrifugal type, double width double inlet, and shall be statically and dynamically balanced as a completed assembly to a maximum vibration level of two mils in any plane. The shaft shall be heavy-duty steel with self-aligning ball bearings with a minimum life span of 100,000 hours. The fan motor shall be mounted on an adjustable slide base. The drive package shall be multi-belt variable speed, sized for 200% of the fan motor horsepower. The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance.

2.3 FILTERS

- A. The filter chamber shall be an integral part of the system located within the cabinet serviceable from either the end, top, or back of the unit depending on the unit configuration. The filters shall be rated not less than 30% efficiency (based on ASHRAE 52-76).

2.4 DIRECT EXPANSION (DX) SPLIT SYSTEMS

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- A. Direct Expansion Coil - Provide an evaporator coil configured as an A-frame and be constructed of copper tubes and aluminum. The coil shall be provided with a stainless steel drain pan.
- B. Refrigeration system - The refrigeration system shall consist of a rugged scroll compressor, pressure safety switches, externally equalized expansion valve, filter dryer, and a refrigerant sight glass and moisture indicator.
- C. Provide a pre-charged refrigerant line set by the unit manufacturer.
- D. Air Cooled Split Systems
 - 1. Propeller Fan Condensing Unit
 - (a) The condenser coil shall be constructed of copper tubes and aluminum fins with a direct drive propeller type fan and shall include a scroll compressor, high pressure switch, Lee-temp receiver, head pressure control valve, and liquid line solenoid valve. All components shall be factory assembled, charged with refrigerant and sealed. No brazing, dehydration, or charging shall be required. Condensing unit shall be designed for 95°F ambient and be capable of operation to -30°F. A hot gas bypass circuit shall be provided to reduce compressor cycling and improve operation under low load conditions.
 - (b) 3 ton models: The condensing module shall be capable of being connected to the evaporator section using pre-charged refrigerant line sets. No brazing, dehydration, or charging shall be required.
 - (c) 5-ton models: Condensing unit must be hard piped with the evaporator. Sweat adapters are shipped loose with all 5 ton evaporators for use on the 5 ton condensing units.

2.5 HUMIDIFIER

- A. Infrared Humidifier - The humidifier shall be of the infrared type consisting of high intensity quartz lamps mounted above and out of the water supply. The evaporator pan shall be stainless steel and arranged to be serviceable without disconnecting high voltage electrical connections. The complete humidifier section shall be pre-piped ready for final connection. The infrared humidification system shall use bypass air to prevent over-humidification of the computer room. The humidifier shall be equipped with an automatic water supply system. The system has an adjustable water-overfeed to prevent mineral precipitation.
- B. Steam Generating Humidifier - The environmental control system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, steam distributor, and electronic controls. The need to change canister shall be annunciated on the microprocessor control panel.

2.6 REHEAT

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- A. Electric Reheat - The low-watt density, 304/304, stainless steel, finned-tubular electric reheat coils shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include UL approved safety switches to protect the system from overheating.
- B. SCR Reheat - The SCR (Silicon Controlled Rectifier) controller shall proportionally control the stainless steel reheats to maintain the selected room temperature. The rapid cycling made possible by the SCR controller provides precise temperature control, and the more constant element temperature improves heater life.
- C. Hot Water Reheat - The hot water reheat coil shall have copper tubes and aluminum fins. The control system shall be factory pre-piped with a 2-way motorized control valve and cleanable Y-strainer.

2.7 CONTROLS

- A. Provide an advanced microprocessor based control processor with a front monitor LCD display panel and control keys for user inputs. The controls shall be menu driven with on-screen prompts for easy user operation. The system shall allow user review and programming of temperature and humidity setpoints, alarm parameters, and setup selections including choice of control type. A password shall be required to make system changes. For all user selections, the range of acceptable input (temperature, humidity, or time delay) shall be displayed on the monitor screen. The system shall provide monitoring of room conditions, operational status in % of each function, component run times, date and time, and four analog inputs from sensors provided by others. The microprocessor shall provide a front monitor LCD backlit display panel with 4 rows of 20 characters with adjustable contrast. This display (along with five front mounted control keys) shall be the only operator interface required to obtain all available system information such as room conditions, operational status, alarms, control and alarm setpoints, and all user selections including alarm delays, sensor calibration, DIP switch selections, and diagnostics. All indicators shall be in language form. No symbols or codes shall be acceptable.
- B. Provide an advanced microprocessor based control processor with a front monitor dot matrix display panel and control keys for user inputs. The controls shall be menu driven with on-screen prompts for easy user operation. The system shall allow user review and programming of temperature and humidity setpoints, alarm parameters, and setup selections including choice of control type. A password shall be required to make system changes. For all user selections, the range of acceptable input (temperature, humidity, or time delay) shall be displayed on the monitor screen. The system shall provide monitoring of room conditions, operational status in % of each function, component run times, date and time, and four analog inputs from sensors provided by others.

2.8 ACCESSORIES

- A. Non-locking disconnect - A non-locking manual disconnect switch shall be mounted in the high voltage section of the electrical panel. The switch shall be accessible from the outside of the unit with the door closed.

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- B. Locking disconnect - A locking, manual disconnect switch shall be mounted in the high voltage section of the electrical panel. The switch shall be accessible from the outside of the unit with the door closed, and prevent access to the high voltage electrical components until switched to the "OFF" position.
- C. Firestat – Provide a firestat that shall immediately shut down the environmental control system when activated. The firestat shall be mounted in the electrical panel with the sensing element in the return air.
- D. Condensate pump - The condensate pump shall have a minimum capacity of 100 GPH at 20 ft. head. It shall be complete with integral float switch, pump and motor assembly, and reservoir.
- E. Floor Stand - The floor stand shall be constructed of a heliarc welded tubular steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be ____ inches high.
- F. Smoke detector – Provide a smoke detector that will immediately shut down the environmental control system and activate the alarm system when activated. The smoke detector shall be mounted in the electrical panel with the sensing element in the return air compartment.
- G. Discharge Plenum - The unit shall be supplied with a 2 way or 3 way or 4 way or ducted air discharge plenum. The plenum shall be 18 in. high, insulated and powder painted the same color as the room unit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install environmental control 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. Connect water supply and drains to air conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.
- C. Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

3.2 QUALITY CONTROL

- A. Start up environmental control units in accordance with manufacturer's start up instructions. Test controls and demonstrate compliance with requirements.

END OF SECTION

SECTION 23-8127
DUCTLESS SPLIT SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide unit sizes scheduled and in locations as shown on drawings and as specified herein.

1.2 SYSTEM DESCRIPTION

- A. The system shall be a direct expansion type as scheduled. Air moving and coil capacity and unit arrangement shall be as shown on drawings. Indoor and outdoor units shall be factory assembled, internally wired and shipped in one piece and shall meet existing regulatory noise standards.

1.3 QUALITY ASSURANCE

- A. Provide unit consisting of UL listed components, factory tested to conform to ASHRAE and ARI standards.

1.4 ACCEPTABLE MANUFACTURERS

- A. Mitsubishi
- B. Sanyo
- C. Daikin
- D. LG
- E. Approved equal

PART 2 - PRODUCTS

2.1 INDOOR UNIT

- A. Unit Cabinet
 1. The indoor unit cabinet shall be wall mounted by means of a factory supplied mounting plate, The cabinet shall be formed from high strength molded plastic with front panel access for filter. Cabinet color shall be white – 12,000 and 18,000 Munsell 0.70 8.59/097, 24,000, 30,000, and 36,000 Munsell 3.4Y 7.7/08.
 2. The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor.
 3. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

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- B. Fan
1. The evaporator fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor – One for 12,000 and 18,000 and 2 for 24,000, 30,000, and 36,000 The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall have four (4) speeds for 12,000 and 18000: Low, M1, M2, and High and two (2) speeds for 24,000, 30,000, and 36,000: Low, High.
- C. Vane
1. There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower noise levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.
- D. Filter
1. Return air shall be filtered by means of an easily removable washable filter.
- E. Coil
1. The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. 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.
- F. Electrical
1. The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the Mitsubishi Electric A-Control system. For A-Control, a three (3) conductor AWG-14 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.
- G. Control
1. The control system shall consist of two (2) microprocessors, one on each indoor and
 - (a) outdoor unit. Field wiring shall run directly from the indoor unit interconnected by a
 - (b) single non-polar two-wire AWG-16 stranded cable to the wall mounted controller
 - (c) with no splices. The control system between the outdoor unit and indoor unit shall be
 - (d) supplied from the outdoor unit using the Mitsubishi Electric A-Control system.
- Reference

2.2 ELECTRICAL

- A. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.
- B. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit.
- C. The indoor unit shall be connected to a wall mounted wired controller to perform input functions necessary to operate the system. The wired controller shall have a large multi-language DOT liquid crystal display (LCD) presenting contents in eight (8) different languages, including English, French, Chinese, German, Japanese, Spanish, Russian, and Italian. There shall be a built-in weekly timer with up to eight pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Dry/Fan mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Vane Position selector, a Louver Swing button, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C). Temperature changes shall be by increments of 1°F (1°C) with a range of 67°F to 87°F (19°C to 30°C).
- D. The wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), LEV opening pulses, sub cooling and discharge super heat.
- E. Normal operation of the wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room. The controller shall have the capability of controlling up to a maximum of sixteen systems at a maximum developed control cable distance of 1,500 feet (500 meters).
- F. The control voltage from the wired controller to the indoor unit shall be 12 volts, DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Up to two wired controllers shall be able to be used to control one unit.
- G. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.

2.3 OUTDOOR UNIT

- A. The outdoor unit shall be compatible with the three different types of indoor units (PKA - wall mounted, PCA - ceiling suspending, and PLA - four way ceiling

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cassette). The connected indoor unit must be of the same capacity as the outdoor unit. Models PUY-A24NHA and PUY-A36NHA or PUZ-A24NHA and PUZ-A36NHA shall have the option to connect to two indoor units, within the same confined space, to improve air distribution (total capacity shall be equivalent to outdoor unit). The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions.

- B. The outdoor unit shall be capable of operating at 0°F (-18°C) ambient temperature without additional low ambient controls (optional wind baffle may be required).
- C. The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) indoor unit to outdoor unit,
- D. System shall have a maximum refrigerant tubing length of 100 feet (30 meters) for the 12,000 and 18,000 and 165 feet (50 meters) for the 24,000, 30,000 and 36,000 between indoor and outdoor units without the need for line size changes, traps or additional oil.
- E. Models shall be pre-charged for a maximum of 70 feet (20 meters) of refrigerant tubing. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
- F. Cabinet - The casing shall be constructed from galvanized steel plate, coated with a finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a munsell 3Y 7.8/1.1 finish. The fan grille shall be of ABS plastic.
- G. Fan - Models shall be furnished with an AC fan motor. The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent contact with moving parts.
- H. Coil - The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.
- I. Compressor - The compressor for models shall be a DC rotary compressor with Variable Compressor Speed Inverter Technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat. The outdoor unit shall have an accumulator and high pressure

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safety switch. The compressor shall be mounted to avoid the transmission of vibration.

- J. Electrical
 - 1. The electrical power of the unit shall be 208volts or 230 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The outdoor unit shall be controlled by the microprocessor located in the indoor unit.
 - 2. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions, as by drawings, in locations shown on drawings.
- B. Coordinate electrical connections with Electrical Contractor.
- C. Coordinate controls with Control Contractor.
- D. Charge system and place in operational condition.

3.2 START-UP AND TEST

- A. Start-up unit, test for proper operation and capacity, check for proper control operation.

END OF SECTION

SECTION 23-8239
WALL AND CEILING UNIT HEATER (ELECTRIC)

PART 1 - GENERAL

1.1 **PRODUCTS**

- A. Unit heaters shall be vertical or horizontal as indicated on the drawing by Berko, Markel or specifically approved equal.
- B. The unit heater shall be factory assembled, draw-thru type with an all steel finned type element. Units shall be phosphatized and have factory baked enamel finish. Capacity shall be as indicated on the drawings. 24 volt transformer and heavy-duty type contactors shall be provided.
- C. Fan shall be selected for quiet operation. Motor bearings shall be permanently lubricated. Thermal overload shall be provided to shut down motor and element if normal operating temperatures are exceeded.
- D. The casing shall be constructed of 18-gauge die formed furniture steel, with all corners rounded, fitted, and sanded smooth. The casing shall be of sufficient size to enclose all piping, fan, and coils.
- E. The interior chassis shall be constructed of not less than 16-gauge galvanized steel and coated with rust inhibiting paint.

2.1 **EXECUTION**

- A. Furnish and install unit heaters as shown on the drawings. Units shall be attached to building structure in an approved manner including vibration isolation. Provide testing, balancing and corrections to system as required to insure complete system operation as designed.

END OF SECTION

SECTION 23-8413
HUMIDIFIERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of humidifiers work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of humidifiers, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate humidifiers in accordance with ARI 610 "Standard for Central System Humidifiers".

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS:

- A. General: Except as otherwise indicated, provide packaged humidifiers and ancillary equipment with manufacturer's standard materials and components as indicated and published product information, designed and constructed by manufacturer, and as required for complete installation.

2.2 ELECTRIC EVAPORATIVE STEAM GENERATING UNIT

- A. Unit requirements
 - 1. Enclosure shall be an 18-gauge steel frame with resin cover suitable for finished spaces. Enclosure frame shall constitute a drip pan, having a threaded connection for drain piping. A separate compartment shall house electrical devices and shall be secured to prevent accidental contact with electrical components. The front exterior of the cabinet shall contain the microprocessor controller's digital keypad.
 - 2. Cleanable vaporizing chamber shall be stainless steel with Heli-arc welded seams. The evaporating chamber shall be mounted on slide rails. Electrical, water supply and drain connections shall have unions and plugs to allow convenient removal of the evaporating chamber for cleaning.
 - 3. The humidifier frame shall have pre-punched keyhole style mounting holes located on 16" centers for ease of wall mounting and leveling.

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4. Steam outlet on top of tank shall be configured to connect to a dispersion unit in a duct via hose or pipe.
- B. Immersion heater(s): Heater(s) shall be INCOLOY alloy sheathed resistance type designed for no more than 86 watts per square inch and shall be mounted on the vaporizing chamber's removable cover.
- C. Water requirements: The humidifier shall be capable of generating steam from tap, softened or DI/RO water.
- D. Drain: An electric drain valve shall be mounted on humidifier assembly to allow tank to drain automatically at the end of a humidification season.
- E. Redundant overtemp switch: A factory mounted and wired sensor with manual reset shall sense an over temperature condition and de-energize heater circuit controls.
- F. Humidifier Controls
 1. Microprocessor controller with the following features or functions:
 - (a) Makeup water switch control and low water safety shutdown
 - (b) Fully modulating (0% to 100%) control of humidifier outputs
 - (c) PID control capability.
 - (d) Self diagnostic test at startup.
 - (e) Integral fault relay for remote signaling of alarms
 - (f) A keypad, capable of either unit or remote mounting with a 5' (1.5 m) cable, and able to operate within a temperature range of 32 °F to 122 °F (0 °C to 50 °C)
 - (g) A keypad that provides text backlighting and allows personal password codes
 - (h) A keypad, capable of monitoring and/or controlling the following parameters:
 - (i) Relative humidity (RH) set point and actual conditions in the space (from humidistat or humidity transmitter)
 - (ii) Relative humidity (RH) set point and actual conditions in the duct for variable air volume applications
 - (iii) Relative humidity (RH) high limit set point and actual conditions
 - (iv) Total system demand in % of humidifier capacity
 - (v) Total system output in lbs/hour (kg/hr)
 - (vi) Drain/flush frequency interval and duration
 - (vii) End-of-season drain status (on standard water systems and if ordered as a DI water option)
 - (viii) Window glass surface temperature (in % RH offset application and if ordered as an option)
 - (ix) System alarms
 - (x) Previous fault messages
 - (xi) Up to 20 humidifier functions, depending on programming
 - (xii) Operating temperature

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2. Water level control for softened or hard water: System shall provide for automatic refill, low water cutoff, field adjustable skimmer bleed-off functions and automatic drain down of humidifier. System shall consist of:
 - (a) A water level sensing unit comprised of three metallic probes screwed into a threaded probe head. Probe head shall incorporate probe isolation chamber to eliminate short circuiting between probes caused by mineral coating of probe head. Probe head shall be mounted on the humidifier assembly.
 - (b) A solenoid operated fill valve factory mounted on the humidifier assembly.
 - (c) End of season drain.
3. Control input accessory options:
 - (a) Airflow proving switch

G. Accessories

1. Drain cooler: A thermostatically controlled water valve shall meter an amount of cold water into a stainless steel mixing chamber to temper 212 °F water with a 6 gpm in flow rate to a 140 °F discharge temperature to sanitary system.

H. Humidifier Dispersion Options

1. Headered dispersion panel (based on Dri-Steem "Rapid-sorb"):
 - (a) Each tube bank shall consist of a horizontal header/separator and designated quantity of vertical dispersion tubes necessary to achieve the required steam capacity and absorption distance.
 - (b) The humidifier shall provide absorption characteristics that preclude water accumulation on any in duct surface within 18" of the humidifier tube panel while maintaining conditions of 69% maximum relative humidity at a minimum of 54°F in the duct air stream.
 - (c) Air pressure loss across the humidifier panel shall not exceed less than 0.090" water column at a duct air velocity of 2000 fpm.
 - (d) Header/separator shall span the width of the duct, be constructed of stainless steel and be fitted with connections for dispersion tubes.
 - (i) The dispersion tubes shall extend the height of the duct and shall be fitted with two rows of tubelets on the diametric centerline and spaced 1-1/2" apart.

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- (ii) Each tubelet shall be made of a thermal-resin material designed for high steam temperatures.
- (iii) Each tubelet shall extend through the wall of and into the center of the dispersion tube and contain a steam orifice sized for its required steam capacity.
- (iv) For securing the upper ends of the tubes, a 3/4" x 2" stainless steel L-bracket shall be furnished, which the installer shall attach to the duct or housing.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which humidifiers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF HUMIDIFIERS

- A. General: Install humidifiers where indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that humidifiers comply with requirements and serve intended purposes.
- B. Access: Provide access space around humidifiers for service as indicated, but in no case less than that recommended by manufacturer.
- C. Support: Provide supports from substrate for humidifiers as indicated and in accordance with manufacturer's installation instructions.
- D. Steam Piping Connections: Provide separate valved branch to supply humidifier from top of dripped steam runout.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation and prior to initial operation, test and demonstrate that air humidification equipment is leak-tight.
- B. Repair or replace air humidification equipment as required to eliminate leaks, and retest as specified to demonstrate compliance.

3.4 ADJUSTING AND CLEANING

- A. Start-Up: Start-up humidifiers in accordance with manufacturer's instructions.
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 26-0500
COMMON WORK RESULTS FROM ELECTRICAL

1. PART 1 - GENERAL

1.1 SCOPE:

- A. The work includes, but is not limited to, the following:
- (1) Complete electrical installation for new freestanding hospital facility including generator to serve emergency loads, system for lighting and power including feeders, panelboards, transformers, branch circuits, lighting fixtures, receptacles and power control wiring for motors and equipment.
Note: this work will be performed in 2 parts, see also specification 01-1100.
-Construction manager (CM) scope includes:
Site lighting
Electrical secondary from transformer
Exterior canopy lighting
Conduit and feeders between panels in main and satellite electrical rooms

-Component Contractor (CC) scope includes
Building complete except as noted above including lighting, power, generator, controls and rough-in for low voltage systems
 - (2) Temporary lighting and power will be under the CM contract.
 - (3) Conduit for systems specified in other sections of this division. See individual sections for requirements.
- B. Connections to equipment furnished by mechanical trades and other sections of this specification.

1.2 RELATED WORK SPECIFIED IN OTHER DIVISIONS

- A. Foundations and pads required for equipment furnished under this Division of the specifications. CM contract.
- B. Field painting, except such as is required to maintain shop coat and factory finish. CC contract within building, CM outside of building
- C. Flashing of conduits into roofing and outside walls. At canopies, provision for interface will be provided under the CC contract with lighting, wiring and connection under the CM contract.
- D. Heating, ventilation, air-conditioning and plumbing equipment.

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E. Nurse call and telecommunications equipment.

1.3 ITEMS OF EQUIPMENT FURNISHED BY MECHANICAL TRADES (note that for this project, this work is included in the CC contract and will be delivered to site as a functional system. The following is provided for CC contractor's use in internal breakout of portions of the work but is not binding. The CC contractor is providing a fully functional system.

A. The following items of equipment, where required, are specified in mechanical DIVISION but shall be installed and connected under this division:

- (1) Thermostats, relays and safety devices.
- (2) Starters (furnished under this division except VFD=s which are furnished by mechanical division) and control devices.

B. Note: Control sequences, operation and function of mechanical equipment is the responsibility of mechanical division. Contractor working under this Division shall make power connections,. Control contractor to furnish, pull and connect control conductors.

1.4 RECORD DRAWINGS

A. Architect will be provided with record drawings as specified elsewhere.

B. Component contractor will provide record drawings of the component building. Construction manager will provide record drawings for all work outside the component scope of work: including feeder conduit routing, site electrical lighting and secondary service routing from transformer as well as telecom service entrance. Contractor shall maintain one set of prints of work specified under this Division on the job site, marked to show as built conditions. Upon completion of project, the Contractor shall prepare record drawings as specified elsewhere.

1.5 SUBMITTALS

A. Shop drawings: Submit in accordance with front end documents the specified number of sets of required detailed data and dimensioned drawings covering: Panelboards, lighting fixtures, wiring devices, etc. Submittal data for other systems shall be required as hereinafter set forth in the individual applicable section. Do not put equipment into manufacture (or order) until shop drawings and brochures have been approved. All required submittal data shall be bound together in one volume with the submittals under each section separately tabbed. Refer elsewhere for preapproval requirements for substitutions.

B. This contract is expected to be funded in whole or in part using funds from the American Recovery and Reinvestment Act (ARRA). Section 1605 of the ARRA prohibits the use of these funds unless all iron, steel, and manufactured goods are produced in the United States. All iron and

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steel manufacturing processes must take place in the United States, except for metallurgical processes involving refinement of steel additives. There is no requirement for the origin of components and subcomponents of manufactured goods. Products listed at 48 CFR 25.104(a) have been determined to be unavailable in the United States and if required for the project may be purchased from foreign sources. No unauthorized use of foreign iron, steel, and/or manufactured goods will be allowed on this project.

1.6 Building shop Drawings

- A. Electrical layout drawings shall be required.
- B. Switchboard, panelboard, transformer, standby electrical system, circuit breaker and disconnect switch submittals shall be accompanied by electrical room, generator room and electrical closet layouts, dimensioned or drawn to scale and showing code required clearances and access. Where electrical equipment is installed in mechanical rooms, the mechanical room layouts shall include all electrical equipment with code required clearances and access. Electrical layout drawings shall be submitted for approval prior to equipment rough-in.
- C. Fabrication drawings shall be provided to engineer for review prior to fabrication.

1.7 ELECTRICAL CODES

- A. Conform to rules of local authority, regulations of the National Electrical Code of the National Board of Fire Underwriters and to Recommendations of the National Fire Protection Association. Obtain permits and certificates of approval from authorities having jurisdiction for the installation. Where requirements of any of the authorities mentioned above differ from the plans or specifications, their requirements shall take precedence over drawings and specifications except where plans and specifications exceed their requirements.
- B. The CC and CM are respectively responsible to be familiar with the codes and particular editions thereof under which the local authority will inspect this work.
- C. Applicable codes are as listed on the coversheet and as follows:
 - (1) National Electrical Code 2008 w/ Alaska amendments
 - (2) NFPA 99 2005
 - (3) NFPA 101 (LSC) 2000

1.8 STANDARDS

- A. All materials and equipment shall be new and bear UL label where such is available and be installed in accordance with labeling.

1.9 REFERENCE AND COORDINATION

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- A. As applicable, refer to and coordinate with other sections and Divisions of this Project Manual, the Drawings and with other trades in the field to prevent delays, interferences and untimely installations.

1.10 SUPERVISION

- A. An authorized and competent representative of the CC shall supervise the component work at fabrication facility. Scheduled inspections for the design engineer to review the work shall be coordinated.
- B. CM work shall be supervised by competent electrical foreman and workmen throughout project duration, insofar as possible.

1.11 INSTRUCTIONS TO OWNER

- A. CC shall furnish for submission to Owner three complete sets of schematics, catalog sheets, manufacturer's specifications, service and instruction manuals and shop drawings, etc., covering items of electrical equipment, panelboards, transfer switches, emergency generator and lighting fixtures. Prepare in neat brochures, bound in flexible back, vinyl-covered loose-leaf notebooks. CM shall supplement this for site lighting.
- B. Instruct Owner in proper usage and care of the entire electrical system including apparatus.

1.12 SAFETY PRECAUTIONS

- A. CM shall provide and maintain proper safeguards for prevention of accidents and any other items required to secure safety of life and property, including sufficient lights during evening hours to secure such protection, and shall coordinate with CC for on site assembly of the component portion of the project..

2. PART 2 - PRODUCTS

2.1 MATERIAL SUBSTITUTION

- A. Where materials, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish standards or desired quality and style and shall be the basis of the bid. Provide materials so specified under this contract, unless changed by mutual agreement. Refer to front end documents for requirements for preapproval of alternates.
- B. In accordance front end documents, after contract for electrical work is let, provide a list of the items proposed for use including manufacturer, brand name, catalog number, etc.

3. PART 3 - EXECUTION

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3.1 DRAWINGS

- A. The electrical plans indicate general layout of complete electrical system, arrangement of feeders, circuits, outlets, switches, controls, panelboards, service equipment, fixtures, and other work.
- B. Field verify scale dimension on plans since locations, distances and elevations will be governed by actual field conditions.
- C. Review architectural, structural, plumbing, heating and ventilation plans and coordinate electrical work with conditions indicated thereon.
- D. Where discrepancies occur in plans and specifications, promptly report them to architect/engineer for resolution.
- E. Include items not specifically mentioned in specifications or noted, but which are obviously necessary to meet requirements of applicable code and make a complete working installation.

3.2 EXCAVATION AND BACKFILLING

- A. Perform excavating and backfilling for underground conduit as specified elsewhere and as shown on the electrical plans.
- B. Caution must be exercised in trenching. Existing buried utilities are shown to the extent known and as possible from surface observation. Alert engineer upon any discrepancies.

3.3 SLEEVES, INSERTS AND OPENINGS

- A. Layout and install electrical work in cooperation with other crafts. Install sleeves or openings through floors or walls required for passage of conduits, pipes and ducts that can not be installed prior to installation of floors or walls.
- B. Sleeves: 24 ga. galvanized sheet steel rigidly supported and suitably packed to prevent ingress of wet concrete.
- C. Install inserts and hangers required to support fixtures, conduit, cables and pull boxes, etc.

3.4 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

- A. CC shall coordinate architectural, plumbing, heating and air conditioning drawings and specifications for items which require electrical connections. Unless specifically indicated otherwise, provide conduits, junction and outlet boxes, circuits, disconnecting switches, wire, fittings, and other electrical items for final connection.
- B. Stub-up and rough-in locations shall be coordinated with actual

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equipment shop drawings.

3.5 IDENTIFYING

A. Install laminated plastic nameplates, white on black background (red background for emergency) engraved with 3/8" letters, centered at top of outside trim for:

- (1) Panelboards
- (2) Disconnect Switches & Enclosed Breakers
- (3) Telephone Cabinets
- (4) System Power Cabinets
- (5) Individually Mounted Starters

B. Plates shall be self adhesive or secured with two round or pan head screws.

C. Nameplates for items on normal power shall have white letters on black background, items on emergency power shall have white letters on red background. Nameplates on each panel, transfer switch, etc., shall indicate the branch of emergency power serving same, i.e., Life Safety, Critical, Equipment. See detail on drawings for size and layout.

D. All boxes and enclosures for emergency circuits shall be marked for ready identification as part of the emergency system. Conduit and boxes, including back boxes, panelboards, etc., shall be spot painted. Conduit shall be identified to within six inches of the box or enclosure. The following color codes shall be utilized:

Yellow	Life Safety Branch
Orange	Critical Branch
Green	Equipment Branch
Red	Fire Alarm System

E. All junction boxes shall be marked to identify wiring within, (panel and circuit number), fire alarm, nurse call etc.

3.6 TEMPORARY LIGHTING AND POWER

A. CM shall provide a temporary electrical lighting and power distribution system of adequate size to properly serve following requirements, including adequate feeder sizes to prevent excessive voltage drop. Temporary work to be installed in a neat and safe manner in accordance with National Electrical Code, Article 305.

B. Provide service and panelboards required for above lighting and power outlets.

C. Install and maintain barricade lighting where required to adequately protect against possible damage and injury.

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3.7 GROUNDING

- A. Accomplish in accordance with Article 250 of the National Electrical Code. See Section 16450.

3.8 ROUGH-IN LOCATIONS

- A. Locate outlets for and make connections to conform with manufacturer's rough-in drawings, and for efficient with convenient use of apparatus connected. No exposed or open wiring will be permitted in finished area.

3.9 FOUNDATIONS AND PADS

- A. CM shall furnish and install all foundations and pads required for equipment provided under this Division of Specifications. Site electrical contractor shall be responsible for proper size and location of foundations, pads, anchor bolts and other items to be built into structure.

3.10 REMOVAL OF DEBRIS

- A. Remove surplus materials and debris caused by, or incidental to, electrical work. Remove such debris at frequent intervals. Keep job clean during construction.

3.11 TESTS (these may be performed at the fabrication site but must be performed after building is completed on site.)

Entire installation shall be free from improper grounds and from shorted and open circuits. Make test to ensure that entire system is in proper operating condition. Include test results in closeout documents and forward to Architect/engineer upon completion of test and prior to call for final observation. The following tests shall be performed and submitted to engineer for evaluation:

- A. Voltage and megger tests on feeder cabling. (CM responsibility)
- B. Service grounding (CM responsibility)
- C. Patient care areas shall have impedance and voltage tested and record of results tabulated in accordance with NFPA 99 4.3.3 (2002). (CC responsibility)
- D. Isolation panel testing (see section 26 24 17) (CC responsibility)

The following testing shall be performed by the contractor or his designated supplier and shall be submitted prior to call for final observation:

- E. Test operation of ALL receptacles while operating under generator power and include a letter verifying that all Ared≡ emergency receptacles are

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indeed hot when operating under generator power and Ivory ≅ normal receptacles are not. (CC responsibility)

- F. Generator load bank testing (CC responsibility)
- G. Fire alarm operation and certification on NFPA 72 form (see section 28 31 00) (CC responsibility)/

3.12 FINAL INSPECTION AND ACCEPTANCE

- A. After completion of electrical work, make a final inspection. Fixtures, lamps, trim, motor connections, control wiring, circuit designations, panelboard labeling etc., shall be completed and in satisfactory operating condition before final acceptance.

3.13 FIRE RATED WALL PENETRATIONS (joint CM/CC responsibility)

- A. Provide U.L. listed firestop system sealants around all conduits passing through all rated walls or floors in accordance with the U.L. Fire Resistance Directory.
- B. The selected system must bear an approved U.L. penetration System number and be installed in accordance with the selected system taking into account the construction and rating of the rated assembly being penetrated and the type of penetration being made.
- C. Approved products shall be coordinated through the general contractor for consistency among trades, representative approved products are as follows:
 - (1) Hilti CS240
 - (2) Tremco FyreShield
 - (3) 3M CP-25

3.14 QUALITY ASSURANCE (CM and CC responsible for respective portions)

- A. Electrical work shall be guaranteed against faulty material or workmanship for a period of one year from the date of final acceptance. If the project is occupied or the systems placed into operation in several phases at the request of the Owner, then the guarantee of each system or piece of equipment used, shall begin on the date each system or piece of equipment was placed in satisfactory operation and accepted as such, in writing, by the Owner. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.
- B. Equipment and material provided under this Division shall be periodically inspected and serviced by competent technicians. This function becomes the responsibility of the Owner when the system is accepted by the Owner. The one year material and workmanship guarantee is not

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intended to supplant normal inspection or service and shall not be construed to mean the Contractor will provide free service nor to correct without charge, breakage, maladjustment, and other trouble caused by improper maintenance.

- C. Any electrical equipment provided under this division shall be turned over to the Owner in operating condition. Instructions on further maintenance shall be included in the operating instructions.
- D. Prior to final observation, leave all systems in proper operating condition.

END OF SECTION

SECTION 26-0510
MOTOR STARTERS/MECHANICAL EQUIPMENT CONNECTION

1. PART 1 - GENERAL

- 1.1 Provide conduit, wiring and power connections to motors, safety switches, starters, relays, electrical interlock circuits and other mechanical equipment. Contractor is cautioned to note carefully the other sections of the specifications describing the electrical equipment to be furnished in order to fully understand the wiring requirements for same. SEE MECHANICAL SHEETS FOR CONTROLS AND WIRING.
- 1.2 FVNR Starters and motor control centers shall be furnished and installed by contractor working under this division.
- 1.3 Electrical line voltage control components (powered smoke dampers, vav boxes etc,) shall be installed by mechanical division and wired by contractor working under this division. This division shall wire and connect line voltage controls in accordance with approved wiring diagrams. This Division shall provide line voltage interlock and control wiring using conduit and No. 14 THHN wire.
- 1.4 The following low voltage (below 50 volts) control wiring shall be furnished and installed by this division. This shall include:
 - medical gas alarm wiring Wired in accordance with manufacturer approved shop drawings

Refer to mechanical and electrical drawings. Wiring shall be and as specified under other sections using conduit and 600V No. 16 Type THHN wire or appropriate multiconductor cable (18 AWG stranded).

- 1.5 Low voltage control wiring for the following systems shall be furnished and installed by mechanical division controls contractor This shall include:
 - HVAC control wiring and interlocks
 - DDC control wiring
 - Smoke damper interlockPower to DDC control panels will be by contractor working under this Division.

2. PART 2 - PRODUCTS

- 2.1 Conduit and wiring required shall be as specified elsewhere within the specification.

3. PART 3 - EXECUTION

- 3.1 Contractor shall determine exact location of all outlets and rough-in connections from equipment shop drawings before installing same. Mechanical drawings shall govern location of equipment and will vary in accordance with equipment being furnished. Electrical drawings showing mechanical requirements are diagrammatic only and indicate only size, type, number of control items and approximate location of same. This division shall furnish the quantity of control

MOTOR STARTERS/MECHANICAL EQUIPMENT CONNECTION 26-0510-2

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conductors required for medical gas equipment to function as designed and indicated on vendor shop drawings.

- 3.2 See details on drawings for J hooks and sleeves for this and other low voltage systems.

END OF SECTION

SECTION 26-0519
ELECTRICAL POWER CONDUCTORS AND CABLE

1. PART 1 - GENERAL

1.1 STANDARDS

- A. Comply with the latest requirements of the current edition of the NEC and ASTM Specifications.
- B. Use only new wire and cable with size, grade or insulation, voltage and manufacturer's name permanently marked on the outer covering at regular intervals.

1.2 DELIVERY AND PROTECTION

- A. Delivery in complete coils and reels, with attached tags identifying size and installation.
- B. Protect wire and cable from weather and damage during storage and handling.

2. PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Soft drawn copper by Anaconda, General Electric or equal. Number 8 ga. and larger shall be stranded construction, number 10 and smaller shall be solid, factory color coded, where available.
- B. In general, meet the following relevant requirements:
 - (1) Conductors for feeders: 600 volt, type THWN or THHN.
 - (2) See section 16168 for conductors and installation requirements in operating rooms and areas fed from isolation power panels.
 - (3) Conductors for lighting and receptacle branch circuits: 600 volt, Type THWN or Type THHN, except as noted herein. Minimum size No. 12 AWG.
 - (4) Conductors for circuits outside building or in moist environments, types THWN.
 - (5) Use Type THHN control circuit wiring, unless another type is designated, or as specified by manufacturer of equipment. Confirm conductor quantity required with mechanical system control schematic.
 - (6) For 24V control systems, multiconductor #18 AWG wiring is

ELECTRICAL POWER CONDUCTORS AND CABLE 26-0519-2

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acceptable. Confirm conductor quantity required with mechanical system control schematic. Belden or West Penn.

- (7) Conductors for fire alarm system: Use No. 14 THHN color-coded wires or plenum rated power limited cable. Conductors may be solid or stranded.
- (8) Fire alarm system: Tag at all junction points and test free from grounds or crosses between conductors. Make final connections between equipment and the wiring system under the direct supervision of a representative of the manufacturer.
- (9) Wire luminaires with medium base sockets with wire not smaller than number 16 and mogul sockets with wire not smaller than number 14, 150E C insulated in accord with current edition of National Electric Code.
- (10) Wire fluorescent luminaires with Type THHN wire not smaller than number 16. Locate no splice or tap within an arm, stem or chain. Wire shall be continuous from splice in outlet box of the building wiring system to lamp socket or to ballast terminals.

2.2 Type AC Cable

- A. For branch circuit work, (normal branch power system only) in wire sizes #12 and #10 type AC cable installed in accordance with NEC 333 shall be allowed in lieu of conduit and wire.
- B. Type AC cable shall have full size insulated ground conductor in addition to phase and neutral conductors. In hospital patient care areas cable shall have redundant ground conductors type HFC cable
- C. Type AC cable shall be run at right angles to building and shall run through and within walls only at right angles. AC cable shall be secured in accordance with NEC.

2.3 SYSTEMS WIRING

- A. Receive and install cabling required for building low voltage communications and security systems. Systems wiring shall be run in conduit or open, bundled and tagged as indicated in respective sections.

3. PART 3 - EXECUTION

3.1 CABLE INSTALLATION

- A. Do not pull conductors into conduits until work which may cause cable damage is completed. Use only approved cable lubricants.
- B. Unless otherwise noted, each conduit raceway shall contain only those conductors constituting a single feeder circuit.

ELECTRICAL POWER CONDUCTORS AND CABLE 26-0519-3

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- C. The maximum number of single phase branch circuits in a single raceway shall be limited to 3 sharing a common neutral as allowed by N.E.C.
- D. Make cable terminals, taps and splices secure with solderless compress on type connectors. Connectors for copper wire shall be Type 54 Series by Thomas & Betts Company or equal and large enough to enclose all conductor strands.
- E. Leave a minimum of 12" slack wire in every outlet box whether it be in use or left as spare for future.
- F. For modular construction, appropriate Amphenol type connectors shall be used at mating points between modules for branch circuits.
- G. Make all splices and connections only at outlet, pull or junction boxes.
- H. All conductors and connections shall test free of grounds, shorts and opens.
- I. Provide number 10 wire in lieu of number 12 wire for any branch circuit in excess of 100' linear length.(larger where specifically noted).
- J. Feeders shall be run under building as indicated on power riser diagram.
- K. Fire alarm system: Tag at all junction points and test free from grounds or crosses between conductors. Make final connections between equipment and the wiring system under the direct supervision of a representative of the manufacturer.

3.2 CONNECTIONS

- A. Connect No. 10 wire, and smaller, with Eagle Wing nuts, or equal.
- B. Connect No. 8 wire, and larger, with compression type, connections, T&B Series 54000, or equal.
- C. Insulate connections of No. 8 wire, and larger, with 3M #33 tape.

3.3 COLOR CODING

- A. Color code conductors as follows:

	<u>120/208V</u>	<u>277/480V</u>
Phase A	Black	Brown
Phase B	Red	Yellow
Phase C	Blue	Orange
Neutral N	White	Gray
Ground G	Green	Green

ELECTRICAL POWER CONDUCTORS AND CABLE 26-0519-4

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- B. Use factory color coded conductors where commercially available. If not, use black wire and band with color tape.

END OF SECTION

SECTION 26-0522
FLEXIBLE METAL CONDUIT

1. PART 1 - GENERAL

1.1 SCOPE

- A. Provide flexible metal conduit for termination at equipment that may vibrate or require adjustment in final location such as motors, lay-in troffers.
- B. Conduit shall be electrically continuous from outlet or conduit end to the utilization equipment.
- C. Where flexible raceway is installed exposed to continuous or intermittent moisture, conduit shall be liquid tight flexible type, Underwriters Laboratories type UA.
- D. Where fittings for liquid tight flexible conduit are brought into an enclosure with a knock-out, a gasket assembly, consisting of one piece "O" ring with Buna-N sealing material, series 5200, shall be installed on outside of box. Fittings shall be made of either steel or malleable iron only, series 5300.
- E. In dry locations, where final connections to motors and other equipment may be made with flexible metal conduit, fittings shall be of steel or malleable iron only, and shall be of wedge and screw type having an angular wedge fitting between convolutions of conduits, series 3100.
- F. A copper ground wire must be installed as a grounding jumper around flexible conduit. The jumper may be installed inside of flexible conduit or outside of conduit to assure a continuity of ground.

2. PART 2 - PRODUCTS

2.1 NOT APPLICABLE

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Complete all conduit systems before pulling the conductor.
- B. Install an insulated copper grounding conductor across or within all flexible conduit serving any utilization device including lighting fixtures, controls and other utilization equipment.
- C. Install all recessed lighting fixtures with flexible metallic conduit from outlet box to fixture. Rigid conduit connections to lighting fixtures are not

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acceptable.

- D. Install liquid tight flexible conduit in such a manner as to prevent liquids from running along the surface toward fittings.
- E. Allow sufficient slack conduit to reduce the effect of vibration, avoid conduits across floors, do not exceed NEC allowable lengths.

END OF SECTION

SECTION 26-0526
GROUNDING AND BONDING

1. PART 1 - GENERAL

1.1 NOT APPLICABLE

2. PART 2 - PRODUCTS

2.1 NOT APPLICABLE

3. PART 3 - EXECUTION

3.1 GROUNDING

- A. Ground electrical system in accordance with Article 250, National Electrical Code and local authorities having jurisdiction.
- B. Products shall be as specified in other applicable sections of this specification.
- C. Do not use flexible metal conduit and fittings as a grounding means. Pull a green ground wire in or around each piece of flexible conduit and screw to conduit system with lugs at both ends.
- D. Install insulated code sized ground wires in all feeder and branch circuits. There shall be 2 ground wires in raceways for isolated ground receptacles. Ground wires shall be larger than Code minimum where so indicated on drawings and as required in section G of this specification.
- E. Attach panel ground bars to panel cans and isolate neutral bars. Neutrals shall be connected to grounds only at service entrance equipment. Panels with isolated ground circuits shall have isolated ground buss in addition to equipment ground buss.
- F. Grounding bushings, as required in other sections of these specifications, shall be bonded to the service entrance equipment ground bus with an insulated conductor sized in accordance with the NEC table 250-94 for equipment grounding conductors.
- G. Secondaries for separately derived systems (step down transformers) shall be grounded in accordance with NEC 250 and at minimum shall consist of grounding conductors bonded to two of the following: grounded structural steel, made electrodes, grounded metal water piping. Full secondary ground wire size shall be carried in primary conduit to main building service entrance or to point where primary feeder ground size is at least equal to secondary ground.
- H. Where drawings indicate isolated grounds the branch circuit conduit shall

have two code sized ground wires (equipment ground and isolated ground) which shall be installed per detail ED102. Isolated ground shall be maintained to service entrance or to first panelboard not required to have isolated ground bus (as indicated on drawings).

3.2 SERVICE GROUNDING

- A. Install grounding electrode conductor (sized per NEC 250 or as shown on drawings) to main water entrance ahead of cut-off valve and to main gas entrance (as allowed by local code).
- B. The system grounds shall be installed and connected as follows: Provide tripod (3) driven ground rods (10' x 3/4" copperweld) arranged approximately 15' equidistant and interconnected with code sized grounding conductor. Connect another code sized bare copper conductor to the main water entrance ahead of the cut-off valve. This same conductor shall be bonded to the building steel. Connect the three grounding conductors to ground bus in service entrance section of main service equipment.
- C. Bond building steel to the ground bus.
- D. Before the grounding electrode conductors are terminated at the ground bus, they shall be temporarily bonded together and tested using a Biddle ground test meter. Ground rods (3/4" x 10' copperweld) shall be driven as required to produce a meter reading of ten ohms or less. Send test data and ohm readings to the Architect at the test conclusion.
- E. Before the grounding electrode conductors are terminated at the ground bus, they shall be temporarily bonded together and tested using a Biddle ground test meter. Ground rods (3/4" x 10' copperweld) shall be driven as required to produce a meter reading of ten ohms or less. Send test data and ohm readings to the Architect at the test conclusion.

3.3 PATIENT AREA GROUNDING AND TESTING

- A. Patient care areas shall have impedance and voltage tested and record of results tabulated in accordance with NFPA 99 4.3.3 (2002). Include test results in closeout documents and forward to Architect/ engineer upon completion of test and prior to call for final observation.

END OF SECTION

SECTION 26-0532
RACEWAYS FOR ELECTRICAL SYSTEMS

1. PART 1 - GENERAL

1.1 PERMITTED CONDUIT USES

- A. Use rigid galvanized or IMC conduit except where EMT or PVC are permitted both by these specifications and local code authorities.
- B. Use rigid galvanized or IMC where penetrating or emerging from concrete slab.
- C. Conduits may be used as itemized below:
 - (1) Service entrance conduits below grade, in concrete or in gravel fill: Rigid metal, IMC or PVC encased in minimum 2" concrete or as indicated on drawings.
 - (2) Panelboard feeders exposed, overhead or in open areas, not subject to physical damage: EMT.
 - (3) Panelboard feeders in concrete floor or fill: Rigid metal, IMC or PVC.
 - (4) Branch circuits in hazardous areas: Rigid metal.
 - (5) Branch circuits in slab on grade or fill: Rigid metal IMC or PVC.
 - (6) Branch circuits, normal power only, concealed overhead: EMT or type AC (HFC) Cable, subject to approval of authority having jurisdiction.
 - (7) Branch circuits exposed: EMT, except in hazardous areas where subject to physical damage and in exterior locations.
 - (8) Branch circuits below exterior grade: Rigid metal or Schedule 40 PVC.
 - (9) Primary conduit to pad mounted transformers: Rigid metal or encased Schedule 40 PVC. Verify Power Company requirements.
 - (10) AC (HFC) cable is not permitted on emergency system feeders or branch circuits.

2. PART 2 - PRODUCTS

2.1 SIZE

RACEWAYS FOR ELECTRICAL SYSTEMS 26-0532-2
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- A. Conduits are to be 2" minimum diameter unless noted otherwise on the drawings.
- 2.2 PVC
 - A. Schedule 40 by Carlon or equal.
- 2.3 RIGID GALVANIZED STEEL, IMC AND EMT
 - A. General Electric, Youngstown Company, Wheatland, Triangle, Republic.
- 2.4 COUPLINGS AND CONNECTIONS
 - A. O.Z. Gedney, Appleton, T&B, EFCOR or equal. EMT fittings shall be compression or steel set screw type
- 2.5 FITTINGS IN EXPOSED CONDUIT
 - A. Connectors, couplings, tees, boxes, ball aligners, etc., Crouse Hinds conduit or equal.
- 2.6 SUPPORTING DEVICES & HANGERS
 - A. Provide appropriate supporting devices and hangers as manufactured by Caddy Fasteners, Steel City, Minerallac or approved equal.

3. PART-3 EXECUTION

- 3.1 INSTALLATION
 - A. Provide complete conduit systems for wire and cable, including outlet and junction boxes, for fire alarm and emergency lighting.
 - B. PVC conduits where used for primary and secondary service entrances and where used for panel feeders longer than 50' shall have rigid conduit elbows and rigid conduit shall emerge from slab.
 - C. Follow layout indicated on plans; however, this layout is diagrammatic. Where changes are necessary due to structural conditions, other apparatus or other causes, make them. Off-sets in conduits are not indicated; furnish as required.
 - D. In slabs on grade having wire mesh reinforcing and no steel bars, install below the vapor barrier.
 - E. Use conduit of sizes indicated and required by NEC for number and sizes of conductors indicated.
 - F. Cut conduit at perpendicular and ream smooth to remove burrs. Cutting by any method which alters the cross section of conduit in any way will

RACEWAYS FOR ELECTRICAL SYSTEMS 26-0532-3
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not be permitted. Keep conduit bends free from dents, kinks and bruises. Protective coating shall be undisturbed. Radii of the bends shall not be less than those stated in current edition of NEC. Do not use more than four 90 degree bends between outlet boxes.

- G. Conduit (metallic) shall be electrically continuous from service equipment to outlets and cabinets. Secure to boxes of sheet metal construction with one locknut outside and one inside box with reinforced bakelite bushing, O.Z. Gedney type "A" through "2" and type "B" for 2-1/2" and larger.
- H. Do not install continuous runs of more than 6 feet of horizontal conduit in walls of any construction. Install horizontal runs in floors or above ceiling.
- I. See that each length of conduit has the manufacturer's name, initials or trademark and the Underwriters' Laboratories Inspection Label thereon.
- J. Where connections are made to motors, not near walls or columns, install a vertical conduit, minimum size 3/4" attached to floor by a floor flange; bring wiring out of this conduit by means of condulets and flexible conduit and extend to motor junction boxes.
- K. Do not use perforated iron or galvanized wire for supporting conduit. Use only fasteners and clips specifically designed for the purpose.
- L. Base required strength of the supporting equipment, size and type of anchors on the combined weight of conduit, hanger and cables.
- M. Support conduits at intervals not to exceed:
 - 1. 2" and 3/4" 5' - 0" o.c.
 - 2. 1" and 1-1/4" 7' - 0" o.c.
 - 3. 1-1/2" and larger 9' - 0" o.c.
- N. Support conduits within three feet of each outlet box, junction box, cabinet or fitting.
- O. Use capped bushings to prevent dirt, concrete, moisture or other foreign matter from entering conduits during construction. Paper, wood or other plugs are unacceptable.
- P. Remove any water from conduits and ducts to avoid freeze damage.
- Q. Conduits to rooftop equipment shall be run in ceiling space below and turn up either at or within rooftop equipment at curb. DO NOT route long runs across roof.
- R. Where installed exposed, run conduits parallel with or at right angles to building lines. Where more than one conduit is following a given path, install with uniform distances between each other and with concentric bends, offsets and saddles.

RACEWAYS FOR ELECTRICAL SYSTEMS 26-0532-4
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- S. Fasten single runs of conduit installed exposed on walls and ceilings with cadmium-plated malleable iron or pressed steel one hole straps, machine screws and lead anchors. Suspend single runs of conduit below ceilings by 3/8" steel rod and malleable iron hinge hangers.
- T. Cut necessary openings in concrete, masonry, brick walls, concrete, wood construction, etc., from both sides to effect a neat workmanlike job.
- U. Coordinate with other trades during placing of concrete and masonry wall construction to ensure proper installation of electrical conduit.
- V. Where conduit passes through building expansion joints, provide O.Z. type "AX" or equal, expansion fittings.
- W. Pull nylon fish wire into conduits left empty.
- X. Provide grounding bushings on all feeder conduits in accordance with NEC 517.
- Y. Provide seal-off fitting in all conduits entering hazardous areas.
- Z. Provide seal-off fittings in all conduits entering walk-in refrigerators or freezer.
- AA. In concrete slabs block up conduit from forms and securely fasten in place. All conduits in slabs shall have a minimum of 1-1/2" concrete coverage above and below.
- BB. Provide fire caulking around all conduits passing through rated wall or floor partitions. Refer to Section 26 05 00 Para. 3.13.
- CC. Junction box covers shall be labeled with panel and circuit numbers of the circuits contained therein.
- DD. Type AC cable shall be run at right angles to building and shall run through and within walls only at right angles. AC cable shall be secured in accordance with NEC.
- EE. In accordance with NEC 517, paint all junction boxes used in the three branches of the emergency power distribution system:

Life Safety Branch	Yellow
Critical Branch	Orange
Equipment Branch	Green
Fire Alarm	Red

END OF SECTION

SECTION 26-0533
BOXES FOR ELECTRICAL SYSTEMS

1. PART 1 - GENERAL

- 1.1 Provide each fixture, switch, receptacle and other wiring devices with an outlet box of appropriate size and depth for its particular location and use unless indicated otherwise.

2. PART 2 - PRODUCTS

2.1 DEVICES

- A. Outlet boxes: Galvanized steel, at least 1 -1/2" deep and of sufficient size to accommodate devices noted, with mounting lugs or ears for covers, knockouts for conduit terminations. Provide boxes for fixtures with fixture studs in center.
- B. Outlet boxes for wiring devices in finished walls: one-piece standard gang type (2 gang min.) or sized to accommodate number of devices noted, with plaster ring covers to bring box openings flush with finished wall or not more than 1/4" back of same. The use of sleeves and long screws to bring device flush with wall plate will not be permitted.
- C. Outlet boxes for lighting, switches and receptacles in areas with exposed conduit: Crouse-Hinds, condulets or equal.
- D. Outlet boxes for telephone/computer system: Metallic one-piece two gang type with plaster ring reducing opening to one gang or as noted on the drawings. Where exposed on wall, use handy box.

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all materials in accordance with the manufacturer's printed instructions and with all applicable codes.
- B. Install bracket outlets at heights indicated.
- C. Install boxes so that the covers will be accessible at all times.
- D. Outlet boxes in walls shall not be mounted back to back. Where drawings show outlets on both sides of the same wall provide short nipples to prevent passage of sound. Refer to installation detail on drawings.
- E. In fire rated walls: outlets in opposing wall faces may not occur within same framing space. Outlets may not exceed 16 square inches (two gang opening each) without application of putty pads.

BOXES FOR ELECTRICAL SYSTEMS 26-0533-2
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- F. Outlet boxes shall be securely fastened to building structure. In stud and drywall construction mount to studs. Provide backing studs where required for precise location of outlets.
- G. All boxes and enclosures for emergency circuits shall be marked for ready identification as part of the emergency system. Conduit and boxes, including back boxes, panelboards, etc., shall be spot painted. Conduit shall be identified to within 6 inches of the box or enclosure. The following color codes shall be utilized:
- | | |
|--------|--------------------|
| Yellow | Life Safety Branch |
| Orange | Critical Branch |
| Green | Equipment Branch |
| Red | Fire Alarm System |
- H. ANormal≅ and Aemergency≅ devices shall be installed in separate boxes.
- I. Junction box covers shall be labeled indicating panelboard and circuit numbers of circuits contained therein.
- J. In fire/smoke and smoke walls fill outlet box opening in drywall tight to the outlet box with fire caulk. Provide putty pads around back sides of outlet boxes as required to preserve rating of wall.

END OF SECTION

PULL AND JUNCTION BOXES FOR ELECTRICAL SYSTEMS 26-0534-1
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SECTION 26-0534
PULL AND JUNCTION BOXES FOR ELECTRICAL SYSTEMS

1. PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

- A. Raceways for electrical systems 26 05 32
- B. Electrical power conductors and cable 26 05 19
- C. Boxes for electrical systems 26 05 33

2. PART 2 - PRODUCTS

2.1 PULL AND JUNCTION BOXES

- A. Fabricated from code gauge sheet steel, with screw covers held in place by corrosion-resistant machine screws.
- B. Box sizes: As required by the NEC for number of conduits and conductors entering and leaving it.
- C. Provide pull and junction boxes of appropriate size configuration and depth or as indicated on the drawings and as specified hereinafter.
- D. For interior work, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, 3/4" flanges, screw covers, etc.
- E. For exterior work, above grade, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, 3/4" flanges and bolted covers with full gaskets forming completely raintight assembly, equal to Keystone Type KRC.

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install where indicated and where necessary to facilitate cable pulling and splicing.
- B. Install boxes in conduit runs wherever necessary to avoid excessive run length or more conduit bends than code allows.
- C. Rigidly secure boxes to walls or ceilings. Conduit runs will not be considered adequate support.
- D. Install boxes in accessible locations. Size boxes in accordance with NEC.
- E. Do not install pull or junction boxes for joint use of line voltage and signal or low voltage controls unless all conductors are insulated for the highest voltage.

END OF SECTION

SURFACE METAL RACEWAYS FOR ELECTRICAL SYSTEMS 26-0537-1
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SECTION 26-0537
SURFACE METAL RACEWAYS FOR ELECTRICAL SYSTEMS

1. PART 1 - GENERAL

- 1.1 Provide service metal raceway systems with elbows, fittings and outlets.
- 1.2 Surface metal raceway systems shall be mechanically and electrically continuous from outlet to outlet and from outlets to cabinets, pull or junction boxes.
- 1.3 Use surface metal raceway systems in laboratories and in other areas where multiple outlet assemblies are required and for extension of circuits along existing walls.

2. PART 2 - PRODUCTS

- 2.1 Catalog numbers are representative products by Wiremold, Products may be wiremold or equal.
- 2.2 Provide surface metal raceway systems with minimum cross sectional dimensions of 3/4" x 2 1/32" (#700) for surface mounted wiring extension to individually mounted switches and receptacles in 5700 series gang boxes.
- 2.3 For multi-outlet assemblies, provide:

7/8" x 1-1/4" (#G-2100)
1-7/16" x 2-3/4" (#G-3000) IN LABORATORY
- 2.4 Provide 15 AMP, 125 volt single receptacles as specified under Section 26 27 26 on molding larger than #2100.
- 2.5 Provide 15 AMP, 250 volt single receptacles as specified under Section 26 27 26.
- 2.6 Provide 30 AMP, 250 volt single receptacles as specified under Section 26 27 26.
- 2.7 Provide device plates as specified under Section 26 27 26.

3. PART 3 - EXECUTION

- 3.1 Secure raceway to wall or casework using pan head type toggle bolts with one located at each end of each run plus additional bolts spaced 24" on center.
- 3.2 Run surface metal raceways parallel and at right angles to building lines.
- 3.3 Locate raceways over counter tops, and under reagent shelf where shown.
- 3.4 Provide separate insulated green grounding conductors in surface metal

SURFACE METAL RACEWAYS FOR ELECTRICAL SYSTEMS 26-0537-2
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raceways for all receptacles.

- 3.5 Feeds to surface metal raceway system shall be through a flush or surface outlet box set in or on the wall as required due to the prevailing conditions.

END OF SECTION

SECTION 26-0539
ELECTRICAL FLOOR DUCTS

1. PART 1 - GENERAL

- 1.1 Provide a complete under floor and/or trench duct system as indicated on the drawings and specified hereinafter. REFER ALSO TO VENDOR RADIOLOGY DRAWINGS FOR DUCT REQUIREMENTS.
- 1.2 Submit for approval specific dimensional shop drawings for all duct systems including header boxes, duct, mounting, hardware, presets, activation kits and wiring partitions.
- 1.3 Entire duct system shall be UL listed.
- 1.4 Obtain approval before bidding or quoting substitutions to the specific duct systems.

2. PART 2 - PRODUCTS

- 2.1 TRENCH DUCT SYSTEM:
 - A. Provide a trench duct system sized as indicated on the electrical or the vendor drawings. Trench duct cover shall be fully gasketed and flush with finished floor. Securing bolts shall be countersunk.
 - B. Compartment dividers shall be adjustable and set as indicated on the drawings.
 - C. Manufacturers: Walker or Square D or equal.

3. PART 3 - EXECUTION

- 3.1 Install entire duct system in accordance with manufacturer's recommendations, the structural drawings and in full coordination with the other affected trades.
- 3.2 Under floor raceway system shall be installed and leveled before concrete pour with presets located approximately 1/8" below final screed line.
- 3.3 Trench duct system shall be installed so that top of trench duct will be flush with final floor. Consult architectural drawings and general contractor for thickness of floor coverings to be placed atop concrete floor.

END OF SECTION

SECTION 26-2213
LOW VOLTAGE DISTRIBUTION TRANSFORMERS

1. PART 1 - GENERAL

1.1 SUBMITTALS

- A. Provide manufacturers catalog data clearly marked to indicate transformers to be furnished.

2. PART 2 - PRODUCTS

2.1 DRY TYPE TRANSFORMERS

- A. Three phase, 480 volt delta primary and 208Y/120V secondary. Furnish with 4 2-1/2% taps below normal and 2 2-1/2% taps above normal, 150 degree temperature rise above 40 degree ambient. All insulating materials shall be in accordance with NEMA standards ST20-1972 for a 220 degree U.L. component recognized insulation system. Sound level shall not be higher than NEMA standard.
- B. Provide "K" factor transformers, electrostatically shielded transformers and single phase transformers as noted on drawings.

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install transformers at locations shown on drawings. Provide channel iron rails under all floor mounted transformers, with spring or rubber-n-sheet isolators. Wall mounted transformers shall be suspended from the structure above or on brackets secured to the wall to carry transformer weight. Provide spring type or rubber-n-sheet isolators under all dry type transformers.
- B. Install and connect all transformers in accordance with manufacturer's printed instruction and detail on electrical drawings. Provide grounding as per NEC Article 250.
- C. Refer to drawings for transformer sizes.

END OF SECTION

SECTION 26-2413
SWITCHBOARDS

1. PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE:

- A. Common work results from electrical 26 05 00

1.2 SUBMITTALS:

- A. Submit catalog data/shop drawings and obtain approval before ordering. Submittal data shall include bussing arrangement and ampacity, switch or breaker sizes ampacity and arrangement, gutter sizes arrangement and entrance locations for cables, metering, overall dimensions and component and integrated equipment bracing and amp interrupting capacities.
- B. Manufacturer shall provide fault current coordination documentation as part of submittal data.

1.3 STANDARDS

- A. Power distribution switchboards must be UL approved for the service intended. Main service equipment shall be UL approved for service entrance.

2. PART 2 - PRODUCTS

2.1 MAIN SWITCHBOARD:

- A. Switchboard is existing 2 Stage ground fault board. Breakers being added shall be GF type and shall be fully coordinated and compatible with the existing equipment. Entire switchboard shall be UL listed.
- B. To existing switchboard add transient suppression sine wave tracking type: Innovative Technologies HDP series, Surge Suppression Inc. LSE series or equal.
- C. Distribution section branch circuit breakers 400A and smaller shall be of the current limiting type equal to Square D, I Limiter type or as indicated on drawings equipped with ground fault protection, (second level).
- D. Distribution section branch circuit breakers 600A and larger shall be of the solid state trip type with adjustable ampere setting from .7X to 1.0X rating of plug and adjustable short time delay from 2X to 6X and have integral ground fault protection. Square D PE or equal. Adjustable settings are to be adjusted for a fully coordinated overcurrent protection system. (As indicated on drawings)

3. PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install new breakers in existing board where indicated on the Drawings and in accordance with all applicable codes. Factory technical shall prepare layout drawing for the added breakers showing specific layout and coordinate for all mounting hardware and buss connections which are required. This shall be documented on the shop drawing.
- B. Contractor shall submit shop drawings for approval prior to fabrication. Shop drawings shall show complete dimensions, arrangement and construction of switchboard, including busing arrangement and ampacity; number and type of switches and circuit breakers with their ampacity and minimum symmetrical interrupting capacity; number and type of spares; and dimensions of space available for addition of future switches and circuit breakers. A specific drawing for the switchboard to be furnished shall be provided.
- C. Upon completion of all work and prior to building occupancy the switchboard shall be de-energized and then vacuumed and cleaned of all dirt and debris.
- D. All openings at future breaker space etc., in switchboard shall be closed rendering a completely deadfront enclosure.
- E. Voltage, bracing, interrupting capacities of overcurrent devices and ampere ratings of overcurrent devices shall be as scheduled on the drawings.
- F. Neutral bus shall be 100 percent rated and have disconnect link.
- G. Provide full 50 percent ground bus at bottom of unit.
- H. When ground fault protection is furnished for branch circuit devices in addition to main circuit device, relays shall be coordinated so that branch circuits will be tripped before main circuit.

END OF SECTION

SECTION 26-2416
PANELBOARDS

1. PART 1 - GENERAL

1.1 SCOPE

- A. Provide dead front type circuit breaker and fusible panelboards as indicated and scheduled on the drawings and as specified hereinafter.

1.2 SUBMITTALS

- A. Submit for approval specific shop drawings or factory work sheets for each panelboard proposed for this project, furnishing all information necessary to properly evaluate proposed equipment including exact overall tub size, breaker or fuse size and quantity, integrated equipment overall A.I.C., spares, spaces and location of feeder conduit entrance, panel designation etc.

1.3 STANDARDS

- A. Power and distribution panelboards must be UL approved for service entrance equipment where used as such.

2. PART 2 - PRODUCTS

2.1 PANELBOARDS - DISTRIBUTION, POWER AND LIGHTING

- A. Provide panelboards with lugs, UL approved, for copper conductors.
- B. Provide electrically isolated neutral bars.
- C. Provide separate ground bars complete with lugs for ground wires. Bond ground bus to panelboard enclosure.
- D. Refer to drawings for voltage and phase characteristics, mounting, over current protection sizes and quantity, and panelboard type and style. Ampere Interrupting capacity shall be industry standard of 10,000 AIC for 120/208V and 14,000 AIC for 277/480V panelboards except as noted on schedules to be higher. Fusible panelboards shall have 100,000 AIC rating with RK-1 fuses. When series rated devices are submitted the series rating shall be clearly identified both on the submittal and proper series rating identification provided on the panels indicating required replacement overcurrent devices to maintain series rating.
- E. All circuit breakers in circuit breaker type panelboards shall be thermal magnetic type with full rating at 40° C ambient. Breaker shall be quick make/break type with visual "trip" indicated by handle in other than ON or OFF position. all multiple breakers will have internal common trip. All shall be bolt-on construction. Plug on circuit breakers are acceptable only

- in loadcenter construction (only as specifically noted on drawings).
- F. Fusible panelboards shall have quick make/break safety switches (800A and less), Square D, QMB, General Electric, QMR or equal, and bolt lock type switches (801A and larger), Pringle, Square D bolt loc or equal. Refer to Section 16181 for fuses.
 - G. All panelboard doors shall have concealed hinges and trim fasteners and common keyed locking latches. Loadcenter type panelboards (only where indicated on drawings) may be furnished without locking latch.
 - H. Panelboards shall bear service entrance label where required.
 - I. Panelboards shall be Square D, General Electric, Westinghouse/Cutler Hammer and shall be of the style and type indicated on the drawings.
 - J. Provide shunt trips for breakers where indicated.
 - K. Provide 120V shunt trips for all breakers serving cooking equipment under exhaust hood in kitchens.
 - L. Provide transient suppression devices on panelboards as indicated, fixed clamping type: Innovative Technologies HDP series, Surge Suppression Inc. LSE series.

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all materials in accordance with the manufacturer's printed instructions and with all applicable codes.
- B. Bond ground bars to panel boxes and to the main service entrance ground bus with a code-sized grounding conductor installed in the same conduit as the phase and neutral conductors.
- C. See Section 26 05 26, Grounding and bonding.
- D. Install all circuits using a common neutral in accordance with the latest edition of the National Electrical Code, Article Nos. 100, 210-4, 210-5, 220-4d and 310-16, Note 8. Balance all circuits to achieve not greater than 10% balanced neutral current in panel feeders.
- E. Provide typed directory cards under plastic on the doors of lighting panelboards. Directories shall indicate devices being served including number, name or description of space in which devices or fixtures are located.
- F. Provide engraved phenolic nameplates for all breakers on power panelboards. Indicate the device, panel or motor being served. Letters shall be 1/4" high. Secure all nameplates to panelboard trim with self

PANELBOARDS 26-2416-3

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- G. adhesive or two round-head sheet metal screws. See detail on drawings. Provide engraved bakelite nameplates on the visible face of all lighting and power panels indicating the panel designation in 3/8" letters. Secure nameplates with self adhesive or two round-head sheet metal screws. See detail on drawings
- H. From each flush mounted panelboard stub a minimum of (2) 1 2" empty conduits into area above ceiling.
- I. Install panels where indicated on the Drawings and in accordance with all applicable codes.
- J. Conduits terminating at panelboards open bottoms shall have grounding bushings bonded to ground bus with an insulated conductor sized in accordance with the NEC Table for equipment grounding conductors.
- K. Provide lock on devices (approximately 4 per panel) for installation of circuits as designated by the owner, time switch, clock, critical circuits, etc.
- L. Provide a 4" raised poured curb around all conduits exiting floor and routed to an exposed panelboard.

END OF SECTION

ISOLATED UNGROUNDED POWER SUPPLY PANELS 26-2417-1

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SECTION 26-2417

ISOLATED UNGROUNDED POWER SUPPLY PANELS

1. PART 1 - GENERAL

- 1.1 Contractor shall provide complete and in working order isolated ungrounded power supply panels in all operating rooms, C section room and Cath Lab as indicated on the drawings.
- 1.2 Panels shall be low-leakage, isolated, ungrounded self-contained panels and be factory-wired and tested.
- 1.3 Panels shall be suitable for flush mounting. Structure shall consist of 12-gauge cold-rolled, degreased and primed steel backbox with angle for transformer mounting. Flush door with stainless steel piano hinge with lockable catch to provide ready access to circuit breakers.
- 1.4 Isolation transformer shall have insulated core and static shield specifically designed for a high degree of isolation between primary and secondary windings not to exceed 10 microamps. Secondary leakage current to ground of transformer and all secondary wiring (except hazardous detector) shall not exceed 16 microamps. Sound level of unit not to exceed 25 DB. Temperature of transformer enclosure not to exceed 25 degrees F above ambient of 72 degrees F if panel is within reach of patient.
- 1.5 Complete branch circuit protection shall be provided by 2-pole circuit breakers.
- 1.6 Provide an equalizer ground terminal bus with a minimum of 30 compression type terminals for No. 12 to No. 6 copper conductors and one suitable for up to 250 MCM to carry the ground connection to earth.
- 1.7 Ground detector shall be of the dynamic type capable of detecting all combinations of capacitive and resistive, faults, including balanced, unbalanced and hybrid faults. A meter to provide continuous visual indication of total leakage current flowing on monitored system. Meter to be calibrated in milliamps and to indicate danger when hazard current reaches 5 milliamps.
- 1.8 Ground conductor shall incorporate a single push button, which when depressed, will render a complete test of entire system, including meter, lights, audible alarm and trip circuits. Switches for testing which require resetting will not be acceptable. Ground detectors requiring electrical removal from monitored circuit during test or which increase the hazard level of leakage on the monitored circuit during test will not be accepted as equals. Ground detector shall be fused, with fuses accessible from front panel. Open fuses shall be indicated by a clearly distinguishable light on front panel eliminating need to remove fuses for test purposes.
- 1.9 Dynamic hazard detector in panel shall be connected directly to secondary of isolation transformer through two accessible line fuses mounted behind breaker

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door.

- 1.10 The ground detector alarm must be UL listed as a hazard indicator under specification, NFPA 99-1999. Listing under other specifications will not be accepted.

2. PART 2 - PRODUCTS

2.1 Panels shall be as manufactured by Post Glover, Square D or Isotrol.

2.2 Surgical Suite Panels:

A. Panels shall include the following:

- (1) Single-phase transformer rated at 7.5KVA with 277V (or as noted on drawings) volt primary and 120 volt secondary.
- (2) Dynamic ground detector with 5 milliamp indication built into panel.
- (3) 16 2-pole circuit breakers.
- (4) Thirty-point equalizer ground bus.

2.3 Patient Ground Points:

A. All suites, as indicated on drawings, shall have reference and patient ground point modules furnished for each area and shall consist of the following:

- (1) Four Hampden Engineering Company Catalog No. HR-10S-E female grounding receptacles with one 15 inch long flexible conductor, for each module.
- (2) Eighteen-point equalizer ground bus.
- (3) Two Hubbell No. 8300R, 20 AMP, 125 volt duplex receptacles.
- (4) Mount panels so that bottom is at least 24 inches above finished floor.
- (5) See detail on drawings, symbol "PG".

B. Provide two 15 foot grounding conductors per room. Grounding conductor to be 15 feet long, flexible copper with male jack on one end and lug on other end for one cord and insulated alligator clip on the other cord.

3. PART 3 - EXECUTION

ISOLATED UNGROUNDED POWER SUPPLY PANELS 26-2417-3
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- 3.1 Conduit and wiring requirements for these special areas shall be as indicated on the drawings.
- 3.2 No pulling compounds of any type shall be used on the conductors in these areas.
- 3.3 All conduit runs shall be kept as short as possible.
- 3.4 All wire in these areas, except grounding conductor, shall have high dielectric strength and to have a dielectric constant of 3.5 or less. Insulation to be cross-linked polyethylene (XPL).
- 3.5 All conduit terminations in these areas shall have grounding bushings connected with No. 10 AWG green wire grounded back to equalizer ground terminal bus.
- 3.6 Panels shall be located where shown on drawings and shall not be relocated without written permission from the engineer.
- 3.7 **CERTIFIED TESTING BY MANUFACTURER:**
 - A. Contractor shall include cost of and make all arrangements for testing of all ungrounded isolated systems in hospital by a qualified factory technician provided by manufacturer of isolation systems.
 - B. Testing shall include a complete inspection of all connections and materials used, and Contractor to be prepared to demonstrate to factory technician that proper polarity was observed and installation practices were in accordance with drawings and specifications for these systems.
 - C. Factory technician shall then check and record system current leakages and mark system leakage in each individual panel. Indicate primary and secondary voltages of each transformer at its lugs. Factory technician shall further simulate and record level of faults at each of outlets being served by isolating panel. These faults shall be of a magnitude sufficient to bring total leakage current which the LIM sees just above alarm point herein specified to verify correct operating of LIM.
 - D. After all tests have been made, and before final inspection written certification is to be given to architect/engineer, hospital and Owner's representative that system is in accordance with specifications.
 - E. Upon completion of all tests, factory technician shall hold meeting with hospital medical and maintenance staff and thoroughly explain operation of equipment installed and the need and procedure of periodically testing and logging test results. Furnish log books to Maintenance Department and enter first readings of all panels in these log books and clearly instruct hospital maintenance staff as to how future entries should be made. All questions that hospital staff might have shall be answered completely and thoroughly at this time. Proper notification of testing dates and times shall be made to hospital engineer and O.R. supervisor so that they may, at their discretion, witness any of the tests or meetings

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conducted by factory technician.

3.8 SHOP DRAWINGS:

- A. Furnish seven complete sets of shop drawings for all items under above main heading, including panels, annunciators, ground points, etc. in brochure form for approval prior to purchasing equipment.
- B. Three copies of shop drawings to be filed with administrator of hospital after above tests have been made. These drawings and test results to become a part of the close out file.

END OF SECTION

SECTION 26-2418
EQUIPOTENTIALLY GROUNDED AREAS

1. PART 1 - GENERAL

- 1.1 Contractor shall provide complete and in working order equipotentially grounded wiring systems in Trauma and ICU spaces.
- 1.2 Provide an equalizer ground terminal bus in each patient equipment grounding point for trauma, minor procedure and ER exam rooms where applicable.

2. PART 2 - PRODUCTS

2.1 POWER GROUND POINTS:

- A. All suites, as indicated on drawings, shall have patient equipment grounding point modules furnished for each area and shall consist of the following:
 - (1) Four Hampden Engineering Company Catalog No. HR-10S-E female grounding receptacles with one 15 inch long flexible conductor, for each module.
 - (2) Eighteen-point equalizer ground bus.
 - (3) Two Hubbell No. 8300R, 20 AMP, 125 volt duplex receptacles.
 - (4) See detail on drawings, symbol "PG".
- B. Provide two 15 foot grounding conductors per room. Grounding conductor to be 15 feet long, flexible copper with male jack on one end and lug on other end for one cord and insulated alligator clip on the other cord.

3. PART 3 - EXECUTION

- 3.1 Conduit and wiring requirements for these special areas shall be as indicated on the drawings.
- 3.2 No pulling compounds of any type shall be used on the conductors in these areas.
- 3.3 All conduit runs shall be kept as short as possible.
- 3.4 All conduit terminations in these areas shall have grounding bushings connected with No. 10 AWG green wire grounded back to equalizer ground terminal bus.
- 3.5 EQUIPOTENTIAL TESTING:
 - A. Testing shall include a complete inspection of all connections and materials used, and Contractor to be prepared to demonstrate that proper

EQUIPOTENTIALLY GROUNDED AREAS 26-2418-2
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polarity was observed and installation practices were in accordance with drawings and specifications.

- B. Technician shall then check and record resistance ohm readings.
- C. After all tests have been made, written certification to be given to hospital and Owner's representative that system is in accordance with specifications.

3.6 SHOP DRAWINGS:

- A. Furnish shop drawings for all items under above main heading, ground points, etc. in brochure form for approval prior to purchasing equipment.
- B. Three copies of shop drawings to be filed with administrator of hospital after above tests have been made. These drawings and test results to become a part of the close out file.

END OF SECTION

SECTION 26-2419
CIRCUIT DISCONNECTS

1. PART 1 - GENERAL

1.1 SCOPE

- A. Furnish disconnections means as indicated on drawings.

2. PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

- A. General Electric, Square D or equal; general duty (120/208 V) heavy duty (277/480 V) type, quick-make, quick-break, in NEMA Type 1 general purpose enclosure with interlocking cover, unless otherwise indicated.

2.2 EXTERIOR SWITCHES

- A. NEMA Type 3R Raintight for switches located outside the building or where subject to water spray.

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount where indicated on the Drawings or as directed. Coordinate with mechanical division tradesman for acceptable location of disconnecting means when locating on HVAC equipment. DO NOT locate in a manner which obscures nameplate data or interferes with maintenance.
- B. Furnish panelboards, switches, cabinets, enclosures, wireways, etc., with knockouts required, or drill necessary holes in the field.
- C. Provide engraved nameplate on each disconnect indicating item served.

END OF SECTION

SECTION 26-2420
FUSES

1. PART 1 - GENERAL

- 1.1 All fuses shall be UL listed for the applied voltage.
- 1.2 Where required or scheduled, provide fuses of proper type and rating in switchboards, panelboards and safety switches as hereinafter specified.
- 1.3 Submit catalog data for approval before ordering.

2. PART 2 - PRODUCTS

2.1 FUSES

- A. Manufacturer: use only fuses made by one manufacturer.
- B. Fuses are to be 600 volts and less. All fuses are standard dimensions and current limiting with 200,000 amperes interrupting capacity.
- C. Class R fuses for non motor loads (RK-1 fast acting): Bussmann KTN-R or KTS-R Limitron single-element fast acting fuse.
- D. Class R Fuses for motor protection (RK-1 dual-element): Bussman LPN-R or LPS-R Low Peak Dual-Element Fuse. Size at 125% of the motor nameplate current rating or the next standard fuse size. Where excessive ambient temperatures, high inertial motor loads or frequent "on/off" cycling requires larger fuses, coordinate with the equipment.
- E. Class L fuses (601A and larger) for all loads: Bussman KRP-C.

2.2 SPARE FUSE CABINET

- A. Bussman Spare Fuse Cabinet, Catalog No. SFC, or equal.

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all materials in accordance with the manufacturer's printed instructions and with all applicable codes.
- B. Do not ship switches in electrical equipment with fuses already installed. Do not deliver fuses to the job site until the equipment is ready to be energized.
- C. Install Bussmann KTN-R or KTS-R fuses in switches serving circuit

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- breaker panels unless otherwise noted.
- D. Install Bussmann LPN-R or LPS-R in other switches.
- E. Place a fuse identification label showing type and size inside the door of each switch.
- F. Wall-mount the spare fuse cabinet near the electric service equipment.
- G. Provide ten percent or a minimum of three of each size and type of fuse prior to final inspection.

END OF SECTION

SECTION 26-2726
WIRING DEVICES AND PLATES

1. PART 1 - GENERAL

1.1 SUBMITTALS

- A. Provide switches, receptacles and other devices as indicated on the drawings. All devices shall have proper device plates.
- B. Submit manufacturer's data to the Architect and obtain his approval before ordering.

1.2 STANDARDS

- A. All devices shall be UL approved.

2. PART 2 - PRODUCTS

2.1 DEVICE COLOR

- A. Device color shall be ivory (or as selected by architect based on manufacturer standard not premium colors).
- B. Wiring devices on emergency branches shall be red.

2.2 SWITCHES (20 AMP, 120/277V RATED EXCEPT AS NOTED)

- A. Single pole Hubbell #1221-I (-R for emergency circuits)
Double pole Hubbell #1222-I (-R for emergency circuits)
Three-way Hubbell #1223-I (-R for emergency circuits)
Four-way Hubbell #1224-I (-R for emergency circuits)

2.3 RECEPTACLES (20 AMP EXCEPT AS NOTED)

- A. Duplex ground type: Rated 20 AMPS, 125 volts - Hubbell 5352-I for general purposes (non patient care areas) and HBL-8300 safety grounding (20AMP) for safety type.
- B. Hubbell 8300 (R) receptacles shall be used in patient care areas. 20A devices shall be furnished in consoles, Hubbell 8300I (R).
- C. Range receptacle - Leviton 5051 with black plate.
- D. Dryer receptacle - Leviton 5055 with black plate.
- E. Other Receptacles:
 - (1) Hubbell #8300-R (in operating rooms)

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- (2) Hubbell GF5362 for exterior and wet location, Hubbell GF8300 in patient care areas.
- (3) Isolated ground receptacles: Hubbell IG 5362
- (4) Safety grounding (tamperproof) receptacles: Bryant 8300IS, 8300 REDS.
- (5) Surge suppression receptacles: Pass & Seymour TVSS 6362-ISP.

F. Recessed Flush in Floor Service Boxes:

- (1) 4 service fully adjustable steel floor box for:
 - normal receptacle
 - isolated ground receptacle
 - telephone
 - dataWalker RFB-4
- (2) Flush activation cover, carpet trim plate
Walker FAKMII

G. Floor boxes and fittings:

- (1) Plastic Floor Boxes: Hubbell PFB1 for concrete floors.
- (2) 3 service flush brass floor fitting: Hubbell SF39253 with accessories as required .
- (3) Hubbell No. 5352 duplex receptacles.

2.4 OTHER DEVICES

A. Dimmer switches:

- (1) Lutron Nova series slide type, wattage as required.

B. Manual motor starters: Square D Class 2510, poles as required by item served.

C. Motion sensing switches:

Wall switches: Auto-on operation, color to match all other devices
stainless steel plate Watt Stopper WA-100

Ceiling switches: 360 deg PIR sensor equal to Watt Stopper CI-200 360 deg w/ BZ-100 power pack

D. Other special devices are as indicated on the drawings.

2.5 PLATES

A. Provide satin stainless steel wall plates of appropriate type and size for wiring and control devices.

- B. Provide properly designed plates and covers when devices are installed in exposed conduit fittings or outlet boxes.
- C. Verify plate color and selection through Architect.

2.6 MANUFACTURERS

- A. Approved devices include the equivalent specifications of the following manufacturers: Bryant, Hubbell, Leviton, Pass and Seymour, General Electric. Submit samples and obtain Architects approval before substituting on the foregoing.

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wall switches with centerline 45" above finished floor. Where located near doors, install switches on the lock side and clear of door trim a minimum of 4".
- B. Where more than one switch is indicated at an outlet, install switches under a gang plate in an order appropriate to outlet location. Devices of normal and emergency branches are not to be ganged together, provide separate outlet boxes.
- C. Mount receptacles with centerline 18" above finished floor except at cabinets, counters or where noted.
- D. Refer to Architectural Drawings for cabinet locations and mount receptacle box to clear backsplash of all counters by a minimum of two inches.
- E. Install general purpose receptacles in administrative areas, support areas and utility areas.
- F. Ensure proper polarity on all convenience outlets.
- G. Mount weatherproof receptacles vertically.
- H. Grounding: install all convenience outlets in boxes specified under Section 16134 and install a No. 12 green ground wire from device grounding terminal back to the grounding bus in the panelboard.
- I. Install device plates in full contact with wall surface or surface mounted box.
- J. Permanent indication of panelboard and circuit number serving each emergency receptacle in critical care patient areas shall be affixed to the device plate using adhesive backed red engraved nameplates with white

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background, per NEC 517.

- K. Provide safety grounding receptacles in all patient care areas for secure (psychiatric) and pediatric patients. This includes patient room, waiting rooms. Additionally they may be required in other locations where hospital personnel determine that patients may be left unattended.

END OF SECTION

SECTION 26-3213
DIESEL ENGINE DRIVEN GENERATOR SETS

I. PART -1 GENERAL

A. SCOPE:

1. Furnish all labor, material, equipment and related items to install the new emergency electrical generator indicated on the drawings and specified. This shall be part of the overall electrical work.

B. SUBMITTALS:

1. Submit shop drawings/catalog data and obtain approval before ordering.

C. COORDINATION:

1. Coordinate with other trades to preclude delays and interferences.

D. GUARANTEES:

1. One year for the completed assembly (new generator) date after acceptance.

E. STANDARDS:

1. Equipment and installation shall meet requirements of NFPA 99 for a Type 10, Class 48, Level 1 system.
2. Equipment shall be constructed, installed and startup tested in accordance with NFPA 110 "Emergency and standby power systems".

II. PART -2 PRODUCTS

A. MANUFACTURER:

1. Use materials from a manufacturer who can meet the following requirements:
 - a) Been regularly engaged in the manufacture of this type equipment at least 10 years.
 - b) Maintains parts and service facilities locally available to the Owner.
 - c) Can provide complete package responsibility to meet all national, state and local codes including the National Electrical Code and NFPA 99.

B. APPROVED MANUFACTURERS:

1. Caterpillar,(need other distributors within servicing distance!!!)

C. GENERATOR (general description)

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1. Diesel fuel engine driven electric generator system with a minimum KW rating as indicated on the drawings for continuous service. System voltage shall be three phase, four wire, 277/480 v, 60 Hz AC, 0.8 power factor. The system package consists of the following:
 - a) Diesel fuel engine driven electric generator set.
 - b) Engine automatic start/stop control system, including remote at central control station.
 - c) Generator control panel.
 - d) For each generator provide 2 remote annunciators to comply with NFPA 99.

D. SYSTEM COMPONENTS:

1. Engine:
 - a) Diesel fueled, liquid cooled, four cycle, developing required KW.
 - b) Cast construction, with overhead valves and replaceable seat inserts for exhaust valves. Use connecting rods with replaceable inserts and full pressure lubrication to the main and connecting rod bearings.
2. Equip engine with:
 - a) Adjustable isochronous governor to provide 2% speed regulation from No-load to Full-load with automatic overspeed shutdown.
 - b) Air cleaner, fuel and oil filters with replaceable elements, oil pump and fuel transfer pump. Oil drain line from crankcase shall extend beyond support rail and be equipped with petcock for oil drain service and maintenance.
 - c) 12 or 24 volt battery charging DC alternator with transistorized voltage regulator.
 - d) 12 or 24 volt solenoid shift electric starter for remote two-wire starting.
 - e) 12 or 24 volt battery ignition with radio suppression.
 - f) Sensor device plus visual warning device to indicate water jacket temperature less than 70 degrees F.
 - g) Sensor device plus visual pre-alarm warning device to indicate high engine temperature and low lube oil pressure.
 - h) Water jacket heater.
 - i) An automatic engine shutdown device plus visual indicating device that a shutdown occurred from overcrank, overspeed, low oil pressure, excessive engine temperature and common audible alarm device to warn that any one or more of the pre-alarm or alarm conditions exist.
 - j) Oil pressure gauge, coolant temperature gauge and battery charge rate ammeter.
 - k) Elapsed time indicator.
 - l) For each generator, emergency breakglass shutdown switch mounted in new electrical room adjacent to main switchboard,

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equal to ASCO 124304 with cast marking "For Emergency Stop".

3. Engine controls include:
 - a) Automatic remote start/stop.
 - b) Cranking limiter to limit cranking to 60 seconds.
 - c) Three position switch: "Run/Stop/Remote", with visual indicator in remote annunciator(s) indicating when switch is in other than the "remote" position.
4. Alternator:
 - a) Four pole, revolving field, 12 leads, flexible coupled to engine, drip proof construction.
5. Equip alternator with:
 - a) Voltage regulation within plus or minus 2% of rated voltage from No-Load to Full-Load.
 - b) Frequency regulation not to exceed 3 Hertz from No-Load to Full-Load.
 - c) Radio interference suppression to meet civilian requirements.
 - d) Temperature rise to meet NEMA, AIEE and ASA standards.

E. GENERATOR CONTROL PANEL:

1. Engine or wall mounted, completely assembled and wired, dead front and with components meeting applicable NEMA standards for industrial controls and to include:
 - a) Automatic voltage regulator.
 - b) Rheostat with plus or minus 5% voltage adjustment.
 - c) AC ammeter.
 - d) Ammeter phase selector switch, 3 position.
 - e) AC voltmeter.
 - f) Voltmeter phase selector switch, 4 position.
 - g) Frequency meter.
 - h) Manual reset circuit breaker.
 - i) Instrument transformers.
 - j) Automatic starting panel.
 - k) Two step 12 volt battery charger with regulator.
 - l) Charge rate ammeter.
 - m) Start and stop switch for manual operation.
 - n) Cranking limiter.
 - o) Terminals for load connection.

F. AUTOMATIC TRANSFER SWITCHES: ASCO 7000 or equal

1. Shall include necessary components to provide the following:
 - a) Serve load by the normal source except when normal source is interrupted.
 - b) Automatically start generator on normal power interruption and

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transfer load to generator after rated voltage is attained.

2. Automatically return to normal power source upon restoration of normal source but only after 5-15 minute adjustable time delay.
 3. Stop engine following cool down time delay of 5 to 15 minutes adjustable, after load removal from generator.
 4. Provide double break silver cadmium contacts capable of handling both inductive and non-inductive loads and allow for inrush currents of 20 times the continuous rating.
 5. Size switches as indicated on Drawings. ASCO 7000, Russellelectric or Cummins.
 6. Provide analog ammeter with selector switch, and a single pole double throw auxiliary contact on each contactor.
 7. Provide mechanical and electrical interlocks to prevent interconnecting of normal and alternate sources. Contactors shall be mechanically held on normal side.
 8. Provide manual load test switch.
 9. Provide equipment branch transfer switches for delayed transfer and with in phase monitor and auxiliary contacts as required on drawings.
 10. Provide exercise timer for weekly exercise of generator for 30 minute duration. Load shall transfer during exercise period.
 11. Provide overlapping neutral equal to ASCO Option 28.
 - L. Provide manual transfer switch with pushbutton transfer (without sensing controls of automatic switches) ONLY as/if noted on drawings.
 - M. Provide main tie main keyed lockout switch as scheduled on drawings to allow interconnection of the panelboards serving emergency power to transfer switches between the generators should one fail to start.
- G. ACCESSORIES:
1. 24 or 12 volt, two step, fused battery charging circuit with rheostat and ammeter to maintain the starting batteries to full charge.
 2. Starting battery(s): 24 or 12 volts complete with clamps, cable and mounting accessories.
 3. Muffler: hospital grade critical type furnished loose under this division. Provide flexible connection to exhaust piping system. Exhaust piping and insulation shall be by division 15.
 4. Water jacket heater to maintain minimum 70 degrees F temperature in 40 degrees F ambient.

H. FUEL DAY TANK:

1. Engine/generator distributor to specify fuel line size between fuel source (fuel oil loop by div 15) and tank as well as day tank to engine. Day tank to be sized for 2 hours operation at generator full load with fuel cooler and fuel return piping to the day tank. Daytank shall be of heavy-duty steel construction, self-supporting furnished with duplex fuel supply pumps and connected to the fuel loop by others. Fuel pump startup shall be furnished and be float controlled. Provide fuel return pump located on the day tank, to be float controlled by an overfill condition at daytank. Provide check valve on pump inlet to prevent loss of prime. Provide manual hand pump of a size sufficient to supply adequate fuel under manual operation.
2. In addition to standard fittings, day tank shall also include: locking manual fill cap, fuel level gauge, pump test switch, drain petcock and high and low fuel alarm float switches (may be UL approved combination float switch).

High level switch shall illuminate "high level supply" indicator on remote annunciator panel(s) and shut off fuel supply pump. Low level switch shall illuminate "low level supply" indicator on remote annunciator panel(s).
3. Fuel piping between main and day tanks shall have supply and return (overflow) lines. Overflow line shall be or larger capacity than supply line. Installation of piping shall be by Division 15.
4. Provide rupture basin for day tank capable of containing entire tank contents. Basin shall be equipped with switch to close fuel inlet solenoid and be provided with overflow pump to return spillage to main tank. Provide sensor in this area to signal "day tank leak" to the remote annunciator. Use one of the auxillary indicator positions for this purpose.

I. ACCESSORIES:

1. Generator circuit breaker mounted on engine.
2. Antifreeze to protect coolant to -10 degrees F.

J. Annunciator:

1. Remote alarm annunciator(s), storage battery powered, located as shown on drawings and shall have individual visual signal to indicate:
 - a) Generator operating to supply power to load.
 - b) Battery charger malfunctioning.
2. Panels shall have individual visual signals plus a common audible signal to warn of an engine-generator alarm condition to indicate:
 - a) Low lube oil pressure.

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- b) Low water jacket temperature (below 70 degrees F).
 - c) High water jacket temperature.
 - d) Low fuel (less than 3 hour operating supply).
 - e) Overcrank (failure to start).
 - f) Overspeed.
 - g) Indicator light showing other than "Remote" position of generator selector switch.
 - h) High fuel level.
 - i) Interstitial tank leak detection.
3. Provide 2 annunciators for each generator:
- one in the designated 24 hour station
- one in maintenance engineering shop in location as directed.

III. PART -3 EXECUTION

A. INSTALLATION:

- 1. Mount packaged electric plant on a shock or antivibration, mount sized to a 4 inch high concrete pad sized as required.
- 2. The completed engine, generator, controls and accessories shall be capable of emergency load pick-up and stabilized within five percent of rated frequency within ten seconds after loss of the normal power source.
- 3. Installation and insulation of muffler(s) shall be by division 15 with muffler and generator set connection flanges by manufacturer. Installation of muffler shall be in accordance with manufacturer's recommendations.
- 4. Field-test engine under full load for specification compliance. Provide three sets of bound test results to Architect.
- 5. Generator supplier's engineer shall perform four hour load bank test on engine generator set after installation with all loads connected. Provide temporary loads as are required to make engine generator set operate at full rated output. Temporary load bank shall be furnished by generator supplier; received, stored, uncrated and connected by the Contractor. After testing, the contractor shall disconnect, crate and load the temporary loads for shipment. Provide bound copies of test results using format prescribed in NFPA 110 maintenance logs for closeout file to Owner.
- 6. Provide instruction for owner's representative in operation and maintenance log requirements per NFPA 110 requirements.

END OF SECTION

SECTION 26-4100
LIGHTNING PROTECTION
(Priced as alternate)

1. PART 1 - GENERAL

- 1.1 All work specified in this section shall comply with the provisions of Section 26 05 00.
- 1.2 Scope of work to be included is a complete lightning protection. The installation shall meet requirements for securing a UL master label.
- 1.3 Contractor to provide all labor, materials and items of service required for the completion of a functional and unobtrusive system of air terminals, conductor, grounds and other components necessary for the protection of the building against damage by lightning.
- 1.4 The system shall be completely concealed where possible, with only the air terminals and roof conductor visible, and complying in all respects with the following codes:
 - A. Underwriters Laboratories, Inc., No. UL96A
 - B. National Fire Protection Association, No. NFPA 78
- 1.5 The installing Contractor shall be actively engaged in the installation of lightning protection systems and shall be so listed by Underwriters Laboratories. He shall have a minimum of three years of experience in this work.

2. PART 2 - PRODUCTS

- 2.1 All materials used shall be new and be the product of a manufacturer member of Lightning Protection Institute, approved and labeled by UL.
- 2.2 All conductors, terminal and fittings at the roof line shall be aluminum and all components below the roof line shall be copper.
- 2.3 PVC conduit shall be cast into footings and slab where required to allow downleads to exit.
- 2.4 Copper ground loop shall be provided around circumference of entire building addition.

3. PART 3 - EXECUTION

- 3.1 Submit list of material and site specific installation shop drawings to Owner for approval in accordance with Section 26 05 00.
- 3.2 Install all conductors in a downward direction, avoiding trapping or any sharp

bends of cables.

- 3.3 Contractor performing this work shall coordinate with roofing installer and provide roof penetration devices and seals compatible with the roofing system and not voiding the roofing warranty.
- 3.4 System shall be installed by the on site electrical contractor responsible for the balance of the project under supervision of an UL listed installer and "Certified Master Installer" as recognized by the Lightning Protection Institute. System inspection shall be at stages as follows:
1. Underground connections (ground rods, rebar bonding, grounding loop, metallic piping)
 2. Interior connections below roof level including downleads and connection to roof circuits.
 3. Roof level circuits and bonds.
- Proper documentation shall be provided to the engineer and in the closeout documents for the project regarding the satisfactory completion of these inspections.
- 3.5 Final acceptance:
- Procurement of UL certification
 - Installation of UL master 'C' plate near a down lead or in another conspicuous location
 - Installation of manufacturer's plate near UL plate.
 - Any component or method not found in accordance with this specification shall be repaired or replaced without cost to the owner.

END OF SECTION

SECTION 26-5100
LIGHTING EQUIPMENT

1. PART 1 - GENERAL

1.1 DELIVERY AND STORAGE

- A. Deliver luminaires and other lighting equipment in the manufacturer's unopened cartons or containers. Store in a safe, weathertight space.

1.2 STANDARDS

- A. Submit shop drawings/catalog data to the Architect and obtain his approval before ordering.
- B. Submit for approval a complete list of every fixture proposed for this project. Fixture list shall clearly indicate the exact fixture(s) being submitted including all applicable options and operating characteristics. Include a COVER SHEET clearly indicating the supplying distributor and manufacturer and complete catalog number and lamp type for each fixture designation. Contractor shall review and affix his stamp of approval to the list before submitting to Architect. Obtain approval on fixture list before ordering.
- C. All submittals shall consist of original manufacturer cutsheets or original .pdf format prints(not facsimile or photocopy thereof). For architect=s use a color chart shall be included for all fixtures requiring color selection. Actual samples may be requested by architect as deemed necessary for selection.
- D. Submittal shall not be based solely upon catalog number as scheduled but shall include proper voltage characteristics and other operating and mounting characteristics or features as are noted on drawings and as required for proper installation and operation. Refer to head end documents for requirements for preapproval of alternates.
- E. Where possible fixtures shall meet ARRA buy American standards.

2. PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers are as indicated on the lighting fixture schedule. These materials were chosen on a basis of performance, aesthetics, and in many cases, a combination of both. Therefore, if any substitution is considered, the piece of equipment in question must be equivalent to the specified item.

2.2 LUMINAIRES AND LIGHTING EQUIPMENT

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- A. Provide luminaires and lighting equipment complete with suspension accessories, canopies, hickey, sockets, lamps, lamp holders, reflectors, ballasts, diffusing material, louvers, plaster frames, recessing boxes, etc., wired and assembled.
- B. Check Architectural Drawings and make lighting fixtures compatible with ceilings.
- C. Recessed fluorescent fixtures shown with acrylic lenses shall be furnished with minimum .125" thick lenses.

2.3 BALLASTS

- A. Fluorescent ballasts shall be T-8 electronic type equal to Valmont Ultra Miser for 32 or 40 W T8 lamps as scheduled on drawings.
- B. Self-contained emergency lighting ballasts in trauma/OR rooms for T8 or T12 lamps shall illuminate one or two lamps and shall produce nominally 3000 lumens for 5 minutes Bodine Gen 1 or equal
- C. Where necessary provide 277:120 stepdown transformers at individual 120V fixtures to allow connection to 277V circuits as indicated on drawings.

2.4 LAMPS

- A. Fluorescent lamps shall be 32W T8 3500 deg. k unless noted otherwise. Philips F32T8/TL735 or equal by G.E. or Sylvania.
- B. Biaxial and compact fluorescent lamps shall be 3500 Deg. K and sized per fixture schedule. Phillips, G.E. or Sylvania.
- C. Incandescent lamps shall be 130V inside frosted except as noted.
- D. HID lamps shall be of the type as recommended by the manufacturer of the fixture in which they are to be placed.

3. PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in locations as indicated on the Drawings or as directed by the Architect.
- B. Install all fixtures and other equipment in accordance with manufacturer's printed instructions.
- C. Install hold down clips for all lay-in fixtures.
- D. Mount fixtures as called for in schedule on drawings. Determine type of

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ceiling to be installed in each space from the architectural drawings and schedules and coordinate fixture mounting hardware and trims accordingly.

- E. Lighting fixtures shall be structurally supported. Fluorescent fixtures mounted in suspended ceiling shall be supported by, and attached to, the ceiling suspension system as required by N.E.C. 410-16(b). (In seismically rated areas thithe recessed fixtures shall be independently secured to overhead structure with minimum of 2 tie wires.) Incandescent fixtures mounted in suspended ceilings shall be supported by fixtures channels, furnished under this Division, laid across ceiling support channels. Surface mounted fixtures shall be supported from the building structural system by rods, or rods and clamps, or by the fixture outlet box, which in turn shall be supported by rods. Provide fixture studs as required.
- F. Wall mounted fixtures shall be secured to masonry walls with bolts and lead anchors, and to metal stud, dry wall partitions by sheetmetal screws driven into metal studs. Coordinate with contractor for blocking for exterior fixtures.
- G. Receive, store, uncrate, install and furnish lamps in fixtures shown in drawings schedule that are to be furnished by others.
- H. Adjustable light fixtures shall be adjusted for optimum distribution of light.
- I. Lighting fixtures shall be located as shown on the architectural reflected ceiling plan.
- J. Provide fixtures suitable for concrete mounting when schedule calls for fixtures to be so mounted.
- K. Connect recessed lighting fixtures to outlet boxes by means of a short piece (not in excess of 6') of flexible conduit or type AC cable with pulled green ground conductor. Each such fixture connection shall be from an outlet box. DO NOT loop flex feed fixtures (except in ceiling cove fixture applications).
- L. Provide lamps for fixtures throughout the project, whether or not furnished by Contractor.
- M. Roadway and Area Luminaires: The General Contractor will provide concrete bases as required for poles as indicated. This Contractor shall coordinate with General Contractor for proper size of bases, anchor bolt arrangements, conduit stubs up to pole bases, etc. Furnish anchor bolts to General Contractor.
- N. Contractor shall adjust or rotate building accent, area and roadway lighting at night to maximize light utilization in intended areas.

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- O. Existing site lighting poles and fixtures shall be cleaned, relamped, painted before reinstallation.
- P. Effectively ground all luminaires to poles and all poles to equipment grounding conductor and to separate 3/4" diameter X 10' copperweld ground rod driven at base of each pole. See detail ED201.
- Q. Provide fuseblocks within access of handhole to protect each circuit from failure of individual ballast in individual fixture.

END OF SECTION

PAD MOUNT TRANSFORMER ELECTRIC SERVICE 26-5500-1
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SECTION 26-5500
PAD MOUNT TRANSFORMER ELECTRIC SERVICE

1. PART 1 - GENERAL

- 1.1 Service available will be underground and will be of the following voltage characteristics: 277/480v 3 phase 4 wire
- 1.2 Service to be grounded in accordance with latest edition of National Electric Code. Article No. 250 and any special requirements as required by Municipal, State or Federal authorities having jurisdiction. See Section 16450 of these specifications.
- 1.3 System will be serviced by: City of Wrangell electric department

2. PART 2 - PRODUCTS

- 2.1 Specific products to be as called for in the Basic Materials Section of these specifications.

3. PART 3 - EXECUTION

- 3.1 Electrical contractor shall coordinate with Wrangell electric to determine final exact location of transformer pad, exact size required and conduit stub-up points for secondary conductors.
- 3.2 Metering to be provided by Wrangell Electric in CT cabinet on building exterior. CT cabinet shall be stainless steel nominal 36" sq X 12" deep with mounting hardware for fixed CT's within cabinet. Confirm specifics with Wrangell Electric prior to purchase and installation.
- 3.3 All primary service routing including underground conductors, marker tape etc. shall be furnished by utility up to the point of demarcation indicated on site plan. Cost for this work shall be included in the project scope of work. Secondary service conduit and conductors are to be Contractor furnished and terminated by utility at transformer.
- 3.4 Pad transformer shall be furnished by the utility. This contractor is to coordinate conduit stub-ups within premanufactured transformer pad.
- 3.5 Contractor shall coordinate location and access with utility's requirements.
- 3.6 Verify and include utility charges for electrical service.

END OF SECTION

SECTION 27-0513.1
TELEPHONE and DATA WIRING PROVISIONS

1. PART 1 - GENERAL

- 1.1 Coordination:
Coordinate placement and installation of conduit and boxes with other trades to preclude delays and interferences.
- 1.2 Refer to drawings for rough-in requirements.
- 1.3 Outlets:
This specification covers rough-in outlet provisions for telephone and data(computer). Floor outlet box provisions shall be as specified in section 16134.

2. PART 2 - PRODUCTS

- 2.1 Outlet boxes:
Two gang outlet box with single gang plaster ring except as specifically noted otherwise on communication vendor drawings. .
- 2.2 Conduit:
3/4" minimum size of same stock as used generally throughout the building.
- 2.3 Conductors:
Furnished and installed by others.
- 2.4 Telephone terminal Board (TTB):
 - A. 3/4" A-D plywood. Paint with two coats of flat gray enamel, with #6 ground wire to service ground bus.

3. PART 3 - EXECUTION

- 3.1 INSTALLATION:
 - A. Install conduit and boxes in the locations indicated on the Drawings or as directed by the Communications vendor's representative.
 - B. Leave pullstrings for cable installation by others.
 - C. Where open cable is run above dropped ceilings and penetrates a smoke or fire rated wall, this Contractor shall furnish and install a minimum 1" empty sleeve extended one foot on both sides of the partitions with bushings at both ends. Conduit to be sealed with fire caulk material. Refer

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to section 26 05 00.

- D. Sleeves to be coordinated with telephone supplier as to location, size and quantity. Cables to be bundled and supported from roof structure.
- E. Stub conduits out from boxes to above accessible ceiling. Provide 90 deg radius and plastic bushing on open conduit end.
- F. See details on drawings for J hooks and sleeves for this and other low voltage systems.

END OF SECTION

SECTION 27-0513.2
DICTATION, INTERCOM, MUSIC, PAGING and TV

1. PART 1 - GENERAL

- 1.1 The dictation, intercom, music, paging and television systems are furnished by others to the owner. The Division 16 contractor shall make rough-in provisions as shown on the drawings and as follows herein. System to be provided and connected under direct contract with the Owner. The electrical Contractor shall provide rough-in only as described hereinafter.
- 1.2 This Electrical Contractor shall provide and install rough-in conduit boxes as specified and shown on the drawings and vendor wiring schematics. Special back boxes are provided by Communications Contractor and installed by the Electrical Contractor.
- 1.3 The Electrical Contractor to install pullstrings to facilitate installation of wiring by the Communications Contractor.

2. PART 2 - PRODUCTS

- 2.1 Equipment is furnished by others directly to owner.

3. PART 3 - EXECUTION

- 3.1 Wiring to be run by communications contractor from outlets through conduit to accessible ceiling area and thence through accessible ceiling area (not in conduit) to termination points as shown on drawings and vendor wiring schematics.
- 3.2 All system wire to be provided and installed by others.
- 3.3 Where open cable is run above dropped ceilings and penetrates a smoke or fire rated wall, this Contractor shall furnish and install a minimum one inch empty sleeve extended one foot on both sides of the partition with bushing on both ends. Conduit sealed with fire resistant material. Refer to section 16010.
 - A. Sleeves to be coordinated with system supplier as to location, size and quantity.
- 3.4 As indicated on drawings major cable runs between terminal cabinets or closets to be installed in conduit.
- 3.5 See details on drawings for J hooks and sleeves for this and other low voltage systems.

END OF SECTION

SECTION 27-0513.3
CODE BLUE and NURSE CALL PROVISIONS

1. PART 1 - GENERAL

1.1 RELATED ITEMS SPECIFIED IN OTHER SECTIONS:

- A. Conduit, outlet boxes and junction boxes.

1.2 DESCRIPTION OF SYSTEMS:

- A. Systems are selected and furnished for the owner by the communications contractor.
- B. Special backboxes and wire will be furnished to contractor working under this division. This contractor shall receive, install boxes and leave pullstring for wire installation by others.

2. PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS:

- A. All components shall be furnished by communication vendors to owner.
- B. Wiring: as required by system manufacturer, furnished by communications vendor.

3. PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install all rough-in provisions where shown.
- B. Protect all items being removed in demolition and intended for reuse.
- C. Where open cable is run above dropped ceilings and penetrates a smoke or fire rated wall, this Contractor shall furnish and install a minimum one inch empty sleeve extended one foot on both sides of the partition with bushing on both ends. Conduit sealed with fire resistant material. Refer to Section 26 05 00.
- D. See details on drawings for J hooks and sleeves for this and other low voltage systems.

END OF SECTION

CONNECTION TO OWNER FURNISHED EQUIPMENT 27-0513.4-1

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**SECTION 27-0513.4
CONNECTION TO OWNER FURNISHED EQUIPMENT**

1. PART 1 - GENERAL

- 1.1 Certain pieces of equipment are to be Owner furnished, such as, x-ray equipment, kitchen equipment, blood refrigerator and alarm, laboratory equipment, consoles, headwall units etc. This equipment to be connected by this Contractor in accordance with manufacturers brochures and instructions.
- 1.2 Check vendor drawings and existing equipment for rough-in and connection requirements.

2. PART 2 - PRODUCTS

- 2.1 Conduit, wire, outlet boxes, disconnect switches, etc., to be provided and installed by this Contractor to conform with applicable section of these specifications.

3. PART 3 - EXECUTION

- 3.1 All equipment to be connected and left in satisfactory operating condition by the Contractor.
- 3.2 For the monitoring system this contractor shall receive and pull the monitoring cable from each patient monitor and the central monitor to the head-in equipment located on contractor furnished plywood backboard in closet as located on the vendor drawings.

END OF SECTION

SECTION 28-3100
FIRE ALARM SYSTEM

1. PART 1 - GENERAL

1.1 SCOPE:

- A. Furnish and install the necessary components for a new stand alone addressable fire alarm system to be wired, connected and left in operating condition. This system shall include power supplies and expansion modules added to the existing system as necessary to expand the system to perform per the following specifications and criteria.

NOTE WELL : project requires control paels in each fire rated portion of building set up so that each can stand alone and operate successfully should other portion of building become incapacitated. Otherwise systems shall act as one.

1.2 SUBMITTALS

- A. Fire alarm Control panel components and peripheral devices shall bear UL approval.
- B. Submittals shall include the following:
- (1) Cut sheet data for each device, panel and panel component clearly indicating UL approval.
 - (2) Shop drawings consisting of:
 - (a) Point to point wiring diagrams prepared specifically for this project indicating all devices, quantity and type of wires between each and interconnection to the fire alarm system.
 - (b) Battery calculation data for 24 hour standby plus 5 minute alarm or as required by local authority having jurisdiction.
 - (c) Fire alarm riser diagram.
 - (d) Address schedule for addressable devices.
 - (3) Wiring diagrams and cut sheet data shall be submitted to, and bear, local authority approval (if required) prior to submission.

1.3 COORDINATION

- A. Coordinate with other trades to preclude delays and interferences.

1.4 GUARANTEE

- A. Guarantee equipment for one year after final acceptance against defects in material and workmanship. Repair or replace defective items during normal working hours upon call.

1.5 SYSTEMS OPERATIONS

- A. Actuation of either an addressable manual station, an automatic smoke or heat detector or a sprinkler system flow switch shall cause alarm signals to sound and indicate on fire alarm control panel and annunciator the location or alphanumeric address of the initiating device.
- B. The control panel and the annunciator shall have a silence switch to discontinue the local audible signal and an acknowledge switch to discontinue the general alarm. The control panel shall have a lockable reset switch which shall restore the system to normal and extinguish all indicating devices.
- C. In the event of an operating power failure, an open circuit, or ground in the system, a trouble signal and trouble lamp shall be actuated at the annunciator and control panel until system is restored to normal. Trouble signal shall be silencable by means of a switch mounted on control panel. Upon restoration of system to normal, trouble signal shall again sound until switch is returned to normal position.
- D. All initiating and alarm (audio and visual) circuits shall be supervised.
- E. System shall include digital communicator interfaced with leased telephone line. This may be accomplished by linking the new fire alarm system to the digital communicator in the existing system
- F. System shall be interfaced with a UL Listed central monitoring station by means of the interface described above.
- G. Initiating circuits for ceiling detectors shall be Class A. Provide smoke detector bases which permit the removal of any open detector without preventing other detectors on that circuit from initiating an alarm.
- H. Operation of a breakglass station, sprinkler waterflow device, area detector or duct smoke detector shall initiate the events as listed on fire alarm schedule on drawings or as herein described.
- I. Furnish for installation into ductwork by mechanical division duct smoke detectors for supply and return air plenums and ducts as shown on drawings. Provide one duct detector upstream from and within five feet of each smoke damper installed in return ducts, exhaust ducts and as shown on mechanical drawing. Each concealed duct detector shall have a red indicating LED ceiling mounted near detector in a standard switchbox with coverplate. LED shall illuminate continuously when the detector senses smoke and remain on until the system is reset.

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- J. Connect sprinkler water flow and tamper switches, furnished under another Division, to fire alarm system.
- K. The Contractor shall review the sprinkler shop drawings and determine the location of all sprinkler heads monitored by each flow switch. Where any head falls within a building zone, supply and return fans serving that building zone shall be shut down as indicated on the drawings. The installation of these switches into the sprinkler system piping shall be done under another Division.
- L. In all cases when an initiating device causes fans to shut down, all smoke dampers in that system shall close. Coordinate with mechanical system controls personnel to assure the proper number of addressable relays required to initiate shutdown or smoke evacuation sequences as required by mechanical control scheme.
- M. Connect valve status switches on each OS&Y cutoff valve and PI valve. Switches shall actuate an audible signal and light on the annunciator and control panel in the event a valve is closed.
- N. Refer to plumbing drawings and sprinkler system submittal drawings for exact location and quantity of flow switches, valve status switches and PIV switches.
- O. Each designated building smoke compartment shall have a separate fire alarm control panel address for each of the following types of devices:
 - (1) Manual stations
 - (2) Ceiling detectors
 - (3) Duct detectors
 - (4) Water flow and valve status switches (building wide not per smoke compartment)
- P. Kitchen hoods furnished under another Division include automatic detectors. Tie each hood control panel into the ceiling detector initiating circuit for the appropriate building smoke compartment.
- Q. Smoke detectors in each individual operating room shall be equipped with contacts in sub base to initiate smoke evacuation fan in that room only on an individual basis.
- R. Provide zone address modules connected to dry contacts in the elevator pit sump alarms. Closure of elevator pit sump alarm contacts indicating high water level shall initiate a supervisory signal on the fire alarm panel and annunciators and shall indicate the pit with high water. It shall initiate no other fire alarm function.

- S. Air handler shutdown and dropping of door hold open magnets shall be programmed on a per floor basis ie. any manual device, ceiling detector, duct detector or waterflow device in any smoke compartment on a given floor shall shutdown all airhandlers serving that floor and drop power to all door hold open and control magnets serving that floor.
- T. Fire alarm sub panels are indicated on the drawings and shall house indicating device power supply and control modules.
- U. Refer to drawings which show door controls to be interfaced with initiation of general fire alarm. These include:
 - cross corridor smoke door to shut
 - locked security doors to be released
 - positive latching door astragals (held open in normal operation) to be released and latch.120v power is to be circulated to all these locations and shall be deenergized upon alarm. (Individual door control devices operating at other voltage characteristics shall be provided with control transformers by the supplier of the device).
- V. The control panel shall accommodate a minimum of 40% spare addresses.
- W. Alarm circuits shall permit silencing the audible alarm without discontinuing the visual alarm.
- X. All end of the line devices (resistors, etc.) locations for supervised circuits shall be clearly indicated on point to point drawings and identified on ceilings at the location.
- Y. The system and all circuits shall be 24 V D.C. Door holder circuits may be 120V, A.C. if circuits are installed in conduit separate from D.C. circuits.
- Z. System shall have:
 - selectable signal tone
 - signal silence timer (adjustable)
 - central station dialer interface
 - alarm verification
 - automatic battery charger with deep discharge protection

2. PART 2 - SYSTEM COMPONENTS

- 2.1 All new components shall be UL listed: Simplex, EST, Harrington or equal.
- 2.2 Power supply panels shall be surface mounted and located as required as per approved shop drawing layout. Designated emergency power circuit from the Life safety branch shall be extended to each power supply panel location.
- 2.3 Batteries (size as required by applicable codes). Sealed, lead, calcium batteries,

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installed within or in separate cabinets adjacent to control panel and sub panels.

- 2.4 Manual Stations: single action addressable type.
- 2.5 Duct Smoke Detectors: addressable true alarm photoelectric with housing and detector with sampling tube (length as required).
- 2.6 Area Smoke Detectors: addressable true alarm photoelectric with 135 degrees F heat internal heat detector (ceiling mounted).
- 2.7 End of Line Relays.
- 2.8 Heat Detectors- addressable (fixed temperature) as noted on drawings.
- 2.9 Heat Detectors- addressable (rate of rise), W/2 N.O. contacts, as noted on drawings.
- 2.10 Door Holders (universal overhead).
- 2.11 Door Holders (wall mounted).
- 2.12 Evacuation Signals, electronically selectable Horn/Chime and Light Combination. Strobe intensity shall be 75cd minimum in corridors and rooms over 200 sf and meet ADA and NFPA 72 recommendations and standards. Evacuation device color shall be off white or as selected by architect.
- 2.13 Main annunciator, 80 character minimum LCD type. Annunciator shall contain key drill switch, trouble indicator and buzzer, trouble silencing switch, key reset switch and pharmacy alarm lights. Furnish 2 annunciators: one at 24 hr station, other at location as desired by fire department personnel and building engineer.
- 2.14 Terminal Cabinets with power supplies as required.
- 2.15 OS&Y Valve Status Switch -- by others.
- 2.16 PI Valve Status Switch -- by others.
- 2.17 Transient suppression devices:
 - A. On 120 volt power source circuit to panel: integral to panel.
 - B. On all terminal connections from any alarm device (low voltage) lead from outside building (PIV, etc.): gas tube arrester TII Industries TII 317A. Locate in fire alarm panel.

3. PART 3 - EXECUTION

- 3.1 INSTALLING AND TESTING:

FIRE ALARM SYSTEM 28-3100-6
Replacement Facility for Wrangell Medical Center - 10528.00
Enfinity Engineering, LLC

- A. Final connections between equipment and wiring systems shall be made under direct supervision of a representative of Licensed fire alarm installing contractor.
- B. Wording for displayed description of addressable devices shall be coordinated with facility engineer.
- C. Provide on each device an ID number. This number shall also display on the annunciator along with the verbal description as indicated above.
- D. Retain the services of Licensed fire alarm installer to oversee the installation of the project, who shall carry out periodic inspections and supervision to assure that the system installation is in accordance with the specifications and manufacturer's requirements.
- E. Testing: Test complete fire alarm system, utilizing services of qualified technician approved by the manufacturer. Testing shall include verification of wiring integrity, device by device operation including all peripheral shutdown and notification function. Closeout documentation shall include completed NFPA 72 A Record of Completion, and certification of UL listing of remote receiving station with which the facility is contracted for remote monitoring.
- F. Mount pull stations with centerline 45" AFF and audio visual devices 80" AFF except as specifically noted.

END OF SECTION