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**Pricing Set
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TABLE OF CONTENTS

SECTION NUMBER	SECTION TITLE
---------------------------	--------------------------

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00 7200	General Conditions
---------	--------------------

DIVISION 01 - GENERAL REQUIREMENTS

01 2500	Substitution Procedures
01 3100	Project Management and Coordination
01 3300	Submittal Procedures
01 7700	Closeout Procedures

DIVISION 02 - EXISTING CONDITIONS

N/A

DIVISION 03 - CONCRETE

03 3100	Cast In Place Concrete
---------	------------------------

DIVISION 04 - MASONRY

04 2000	Unit Masonry Assemblies
---------	-------------------------

DIVISION 05 - METALS

05 1200	Structural Steel
05 4000	Cold-Formed Metal Framing
05 4400	Cold-Formed Metal Trusses
05 5000	Metal Fabrications

DIVISION 06 - WOOD, PLASTICS AND COMPOSITES

06 1000	Rough Carpentry
06 1643	Gypsum Sheathing
06 4100	Wood Casework

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 1313	Sheet Waterproofing
07 2115	Batt Insulation
07 2119	Spray Foam Insulation
07 2200	Roof Insulation
07 2400	Exterior Insulation and Finish System
07 2800	Moisture Barriers
07 5400	Thermoplastic Membrane Roofing
07 6200	Sheet Metal Flashing and Trim
07 6500	Flexible Flashing
07 7100	Roof Specialties
07 8400	Firestopping
07 9200	Joint Sealers

TABLE OF CONTENTS

SECTION NUMBER	SECTION TITLE
---------------------------	--------------------------

DIVISION 08 - OPENINGS

08 1113	Hollow Metal Doors and Frames
08 1416	Flush Wood Doors
08 4113	Aluminum-Framed Entrances and Storefronts
08 7100	Door Hardware
08 8000	Glazing

DIVISION 09 - FINISHES

09 2200	Metal Support Assemblies
09 2900	Gypsum Board
09 5100	Acoustical Ceilings
09 6530	Resilient Base
09 6660	Resilient Sheet Flooring
09 9100	Painting
09 9113	Exterior Painting

DIVISION 10 - SPECIALTIES

10 2650	Wall and Door Protection
10 2813	Toilet Accessories
10 4413	Fire Extinguishers and Cabinets

DIVISION 11 - EQUIPMENT

N/A

DIVISION 12 - FURNISHINGS

N/A

DIVISION 13 - SPECIAL CONSTRUCTION

N/A

DIVISION 14 - CONVEYING EQUIPMENT

N/A

DIVISION 21 – FIRE SUPPRESSION

21 0500	Common Work Results for Fire Suppression
21 1000	Water Based Fire Suppression Systems
21 1000A	Water Based Fire Suppression Calculations

DIVISION 22 - PLUMBING

22 0500	Common Work Results Plumbing
22 0719	Plumbing Insulation

TABLE OF CONTENTS

SECTION NUMBER	SECTION TITLE
---------------------------	--------------------------

22 1116	Domestic Water Piping Valves
22 1119	Domestic Water Piping Specialties
22 1123	Domestic Water Pumps
22 1316	Sanitary Waste and Vent Piping
22 1319	Sanitary Waste Piping Specialties
22 1400	Storm Drainage
22 4300	Healthcare Plumbing Fixtures
22 4500	Emergency Plumbing Fixtures
22 4700	Drinking Fountains & Water Coolers
22 6006	Certification Procedure for Medical Gas Pipelines
22 6013	Medical Gas Piping System
22 6219	Medical Vacuum Equipment
22 6653	Acid Waste, Piping and Equipment

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

23 0500	Common Work Results for HVAC Systems
23 0513	Electric Motors General
23 0548	Vibration Isolation
23 0549	Basic Materials and Methods for HVAC
23 0593	Testing, Adjusting, and Balancing
23 0710	Insulation
23 0800	Commissioning of HVAC
23 2113	Hydronic Piping
23 2116	Hydronic Piping Specialties
23 2123	HVAC Pumps
23 2513	Water Treatment for Closed Hydronic Systems
23 3110	Sheet Metal Ductwork – Low Pressure
23 3111	Sheet Metal Ductwork – Medium Pressure
23 3300	Air Duct Accessories
23 3400	Centrifugal Fans
23 3600	Air Terminal Units
23 4000	HVAC Air Cleaning Devices
23 6410	Air Cooled Water Chillers
23 7313	Air Handling Units
23 8240	Electric Heaters

DIVISION 31 - EARTHWORK

31 3116	Termite Control
---------	-----------------

END OF TABLE OF CONTENTS

DOCUMENT 00 7200

GENERAL CONDITIONS

SUMMARY

- A. Related Documents:
 - 1. Document 00 7300 - Supplementary Conditions.
 - 2. Division 01 - General Requirements.

1.2 DOCUMENT

- A. American Institute of Architects (AIA) Document A201-2007, General Conditions of the Contract for Construction, forms a part of this Contract and by reference is incorporated herein as fully as if repeated at length.

END OF DOCUMENT

SECTION 01 2500

SUBSTITUTION PROCEDURES

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Product Substitution Procedures.

1.2 GENERAL

- A. Definition: Proposal by Contractor to use manufacturer, product, material, or system different from one required in Contract Documents.
- B. Do not substitute Products unless a substitution request has been approved by Architect.
- C. Substitutions during Bidding: Refer to Instructions to Bidders.
- D. Architect will consider substitution requests within 30 days after award of Contract. After initial 30 day period, substitutions requests will be considered only due to non-availability of a specified Product through no fault of Contractor.
- E. In case of non-availability of a specified Product notify Architect in writing as soon as non-availability becomes apparent.

1.3 SUBSTITUTION REQUESTS

- A. Submit substitution requests on Contractor's standard form.
- B. Document specified product and proposed substitution with complete data, including:
 - 1. Product identification, including name and address of manufacturer.
 - 2. Product description, performance and test data, and reference standards.
 - 3. Sample, if requested.
 - 4. Description of any anticipated effect that acceptance of proposed substitution will have on Progress Schedule, construction methods, or other items of Work.
 - 5. Description of any differences between specified product and proposed substitution.
 - 6. Difference in cost between specified product and proposed substitution.
- C. Burden of proof for substantiating compliance of proposed substitution with Contract Document requirements remains with Contractor.
- D. A request constitutes a representation that the Contractor:
 - 1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - 2. Will provide the same warranty for the substitution as for the specified Product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 5. Will reimburse Owner for design services associated with re-approval by authorities or revisions to Contract Documents to accommodate the substitution.
- E. Substitutions will not be considered if:
 - 1. They are indicated or implied on Shop Drawings or other submittals without submittal of a substitution request.
 - 2. Approval will require substantial revision of Contract Documents without additional compensation to Architect.
- F. Submit electronically in Adobe PDF format.

- G. Architect will notify Contractor of approval or rejection of each Substitution Request.
- H. Approved Substitutions will be incorporated into Contract by Change Order or Construction Change Directive.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project coordination.
 - 2. Coordination drawings.
 - 3. Project meetings.
- B. Related Sections:
 - 1. Section 01 7700 - Contract Closeout.

1.2 PROJECT COORDINATION

- A. Submit required project submittals electronically in Abode PDF format.
- B. Coordinate scheduling, submittals, and work of various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.
- C. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.
- D. Coordinate space requirements and installation of mechanical and electrical items that are indicated diagrammatically on Drawings.
 - 1. Follow routing shown as closely as practical; place runs parallel with building lines.
 - 2. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean up of work of separate Sections in preparation for Substantial Completion.
- G. After Owner occupancy, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents to minimize disruption of Owner's activities.

1.3 COORDINATION DRAWINGS

- A. Coordination Drawings:
 - 1. Prior to commencement of Work, prepare coordination drawings to define relationship of mechanical, plumbing, fire protection, and electrical components with beams, columns, ceilings and walls.
 - 2. Include plans, elevations, sections, and details required to define relationships between components.
 - 3. Prepare drawings at 1/4 inch = 1'-0" scale for general layout and 3/8 inch = 1'-0" for plans and sections in congested areas including equipment spaces.
 - 4. Submit electronically in Adobe PDF format.
- B. Hold coordination meetings with trades providing mechanical, plumbing, fire protection, and electrical work.
- C. Resolve conflicts between trades, prepare composite coordination drawings and obtain signatures on original composite coordination Drawings.

- D. When conflicts cannot be resolved:
 - 1. Cease work in areas of conflict and request clarification prior to proceeding.
 - 2. Prepare drawings to define and to indicate proposed solution.
 - 3. Submit drawings for approval when actual measurements and analysis of Drawings and Project Manual indicate that various systems cannot be installed without significant deviation from intent of Contract Documents.
- E. Submit original composite coordination drawings as part of Project Record Documents specified in Section 01 7700.

1.4 PROJECT MEETINGS

- A. Schedule and administer preconstruction conference, progress meetings and pre-installation conferences.
- B. Make physical arrangements for meetings; notify involved parties at least 4 days in advance.
- C. Record significant proceedings and decisions at each meeting; reproduce and distribute copies to parties in attendance and others affected by proceedings and decisions made.

1.5 PRECONSTRUCTION CONFERENCE

- A. Schedule within 15 days after date of Notice to Proceed at central site convenient to all parties.
- B. Attendance:
 - 1. Construction Manager.
 - 2. Owner/Owner's Representative
 - 3. Master Developer
 - 4. Architect and principal consultants.
 - 5. Major subcontractors and suppliers as Construction Manager deems appropriate.
- C. Review and Discuss:
 - 1. Relation and coordination of various parties, and responsible personnel for each party.
 - 2. Use of premises, including office and storage areas, temporary controls, and security procedures.
 - 3. Construction schedule and critical work sequencing.
 - 4. Processing of:
 - a. Contract modifications.
 - b. Shop Drawings, Product Data, and Samples.
 - c. Applications for Payment.
 - d. Substitutions.
 - e. Requests for Information.
 - f. Other required submittals.
 - 5. Adequacy of distribution of Contract Documents.
 - 6. Procedures for maintaining contract closeout submittals.
 - 7. Installation and removal of temporary facilities.
 - 8. Notification procedures and extent of testing and inspection services.

1.6 PROGRESS MEETINGS

- A. Schedule bi-weekly progress meetings.
- B. Location: Construction Manager's Project field office.
- C. Attendance:
 - 1. Construction Manager.
 - 2. Owner/Owner's Representative.
 - 3. Architect and consultants as appropriate to agenda.
 - 4. Subcontractors and suppliers as appropriate to agenda.

5. Others as appropriate to agenda.

D. Review and Discuss:

1. Work progress since previous meeting, including:
 - a. Field observations, deficiencies, conflicts, and problems.
 - b. Progress and completion date.
 - c. Corrective measures needed to maintain quality standards, progress, and completion date.
2. Status of:
 - a. Requests for information.
 - b. Submittals.
 - c. Contract modifications.
3. Coordination between various elements of Work.
4. Maintenance of Project Record Documents.

1.7 PRE-INSTALLATION CONFERENCES

- A. Where required in individual specification Section, convene a pre-installation conference at project site or other designated location.
- B. Require attendance of parties directly affecting or affected by work of the specific Section.
- C. Review conditions of installation, preparation and installation procedures, and coordination with related work.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal procedures.
 - 2. Proposed Products list.
 - 3. Submittal schedule.
 - 4. Shop Drawings.
 - 5. Product Data.
 - 6. Samples.
 - 7. Quality control submittals.

1.2 SUBMITTAL PROCEDURES

- A. Number each submittal with Project Manual section number and a sequential number within each section. Number resubmittals with original number and an alphabetic suffix.
- B. Identify Project, Contractor, Subcontractor or supplier, pertinent Drawing sheet and detail numbers, and specification Section number, as appropriate.
- C. Submit all submittals listed under "Submittals for Review" simultaneously for each Product or Specification Section.
- D. Where multiple Products function as an assembly, group submittals for all related Products into single submittal.
- E. Architect will not review incomplete submittals.
- F. Apply Contractor's stamp, signed or initialed certifying that:
 - 1. Submittal was reviewed.
 - 2. Products, field dimensions, and adjacent construction have been verified.
 - 3. Information has been coordinated with requirements of Work and Contract Documents.
- G. Schedule submittals to expedite the Project, and deliver to Architect. Coordinate submittal of related items.
- H. For each submittal, allow 14 days for Architect's review, excluding delivery time to and from Contractor.
- I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of completed Work.
- J. Revise and resubmit submittals when required; identify all changes made since previous submittal.
- K. Distribute copies of reviewed submittals to concerned parties and to Project Record Documents file. Instruct parties to promptly report any inability to comply with provisions.

1.3 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Notice to Proceed, submit a complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
- C. Submit electronically in Adobe PDF format.

1.4 SUBMITTAL SCHEDULE

- A. Within 15 days after date of Notice to Proceed, submit a submittal schedule showing all submittals proposed for project, including submittals listed as:
 - 1. Submittals for Review.
 - 2. Closeout Submittals.
- B. Include for each submittal:
 - 1. Specification section number.
 - 2. Description of submittal.
 - 3. Type of submittal.
 - 4. Anticipated submittal date.
 - 5. For submittals requiring Architect's review, date reviewed submittal will be required from Architect.
- C. Submit electronically in Adobe PDF format.

1.5 SHOP DRAWINGS

- A. Present information in clear and thorough manner.
- B. Identify details by reference to sheet and detail numbers or room number shown on Drawings.
- C. Reproductions of details contained in Contract Documents are not acceptable.
- D. Submit electronically in Adobe PDF format. Architect will return one copy to Contractor for printing and distribution.

1.6 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, and other data.
- B. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Submit electronically in Adobe PDF format. Architect will return one copy to Contractor for printing and distribution.

1.7 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Where so indicated, submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Architect's selection.
- C. Include identification on each sample, with full Project information.
- D. Unless otherwise specified in individual specifications, submit two of each sample.
- E. Architect will notify Contractor of approval or rejection of samples, or of selection of color, texture, or pattern if full range is submitted.

1.8 QUALITY CONTROL SUBMITTALS

- A. Quality control submittals specified in Section 01 4000 are for information and do not require Architect's responsive action except to require resubmission of incomplete or incorrect information.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 7700

CLOSEOUT PROCEDURES

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Adjusting.
 - 4. Project record documents.
 - 5. Operation and maintenance data.
 - 6. Warranties.
 - 7. Spare parts and maintenance materials.
 - 8. Starting of systems.
 - 9. Demonstration and instructions.

1.2 CLOSEOUT PROCEDURES

- A. Final Inspection:
 - 1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with the Contract Documents and ready for Architect's inspection.
- B. Submit final Application for Payment showing original Contract Sum, adjustments, previous payments, retainage withheld from previous payments, and sum remaining due.
- C. Closeout Submittals:
 - 1. Evidence of compliance with requirements of governing authorities.
 - 2. Certificate of Occupancy.
 - 3. Project Record Documents.
 - 4. Operation and Maintenance Data.
 - 5. Warranties.
 - 6. Keys and keying schedule.
 - 7. Spare parts and maintenance materials.
 - 8. Evidence of payment of Subcontractors and suppliers.
 - 9. Final lien waiver.
 - 10. Certificate of insurance for products and completed operations.
 - 11. Consent of Surety to final payment.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean surfaces exposed to view:
 - 1. Clean glass.
 - 2. Remove temporary labels, stains and foreign substances.
 - 3. Polish transparent and glossy surfaces.
 - 4. Vacuum carpeted surfaces; damp mop hard surface flooring.
- C. Clean equipment and fixtures to a sanitary condition.
- D. Clean or replace filters of operating equipment.
- E. Clean debris from roofs and drainage systems.

- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain following record documents on site; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Material Safety Data Sheets.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Make entries neatly and accurately.
- E. Label each set or volume with title "PROJECT RECORD DOCUMENTS", project title, and description of contents.
 - 1. Organize contents according to Project Manual table of contents.
 - 2. Provide table of contents for each volume.
- F. Drawings: Mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Drawings.
- G. Specifications: Mark each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- H. Shop Drawings: Mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Shop Drawings.
- I. Submit electronically in Adobe PDF format.

1.6 OPERATION AND MAINTENANCE DATA

- A. Identify as "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.
- B. Contents:
 - 1. Directory: List names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Operation and maintenance instructions: Arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

- a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
3. Project documents and certificates including:
- a. Shop drawings and product data.
 - b. HVAC balance reports.
 - c. Certificates.
 - d. Copies of warranties and bonds.
- C. Submittal:
- 1. Submit electronically in Adobe PDF format at least 15 days prior to final inspection.
 - 2. Architect will notify Contractor of any required revisions after final inspection.
 - 3. Revise content of documents as required prior to final submittal.
 - 4. Submit revised documents electronically in Adobe PDF format within 10 days after final inspection.

1.7 WARRANTIES

- A. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.
- B. Include Table of Contents.
- C. Submit electronically in Adobe PDF format along with final Application for Payment.
- D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to Project site in location as directed; obtain receipt prior to final payment.

1.9 STARTING OF SYSTEMS

- A. Notify Owner and Architect at least seven days prior to startup of each system or piece of equipment.
- B. Prior to beginning startup verify that:
 - 1. Lubrication has been performed.
 - 2. Drive rotation, belt tension, control sequences, tests, meter readings, and electrical characteristics are within manufacturer's requirements.
 - 3. Utility connections and support components are complete and tested.
- C. Execute start-up under supervision of applicable manufacturer's representative or Contractor's personnel in accordance with manufacturers' instructions.
- D. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to startup, and to supervise placing equipment or system in operation.
- E. Submit written report that equipment or system has been properly installed and is functioning correctly.

1.10 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed upon times, at equipment location.
- E. Prepare and insert additional data in Operation and Maintenance Manuals when need for additional data becomes apparent during instruction.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 03310

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.02 SUBMITTALS

- A. Product Data: For each manufactured material and product indicated.
- B. Design Mixes: For each concrete mix indicated.
- C. Material certificates.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- B. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.
 - 1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
 - 2. Formwork and form accessories.
 - 3. Steel reinforcement and supports.
 - 4. Concrete mixtures.
 - 5. Handling, placing, and constructing concrete.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Formwork: Furnish formwork and form accessories according to ACI 301.
- B. Steel Reinforcement:
 - 1. Reinforcing Bars: ASTM A 615 Grade 60, deformed.
 - 2. Plain-Steel Wire: ASTM A 82, as drawn.
 - 3. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- C. Concrete Materials:
 - 1. Portland Cement: ASTM C 150, Type I or II or I/II.
 - 2. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-inch nominal size.
 - 3. Water: Complying with ASTM C 94 and potable.
- D. Admixtures:
 - 1. Air-Entraining Admixture: ASTM C 260.
 - 2. Water-Reducing Admixture: ASTM C 494, Type A.
 - 3. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
 - 4. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

- E. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- F. Curing Materials:
 - 1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf.
 - 3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
 - 4. Water: Potable.
 - 5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.02 CONCRETE MIXES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Compressive Strength (28 Days): 3,000 psi.
 - 2. Slump: 4 inches.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.
 - 1. Air content of trowel-finished interior concrete floors shall not exceed 3.0 percent.

2.03 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with ASTM C 94 and ASTM C 1116.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.
- B. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.
- C. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 1. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.

2. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - a. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 3. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth indicated, as follows:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.02 CONCRETE PLACEMENT

- A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- B. Consolidate concrete with mechanical vibrating equipment.

3.03 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
 1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, and other bonded cementitious floor finish, unless otherwise indicated.
- D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, paint, or another thin film-finish coating system.
- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom in direction of slab slope.
- G. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.04 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Cure formed and unformed concrete for at least seven days as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist with water or continuous water-fog spray or absorptive cover, water saturated and kept continuously wet.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.
 - 1. Testing Frequency: One composite sample for each day's pour of each concrete mix exceeding 5 cu. yd, but less than 25 cu. yd, plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Testing Frequency: At least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
 - 3. Test Cylinders: A minimum of four (4) shall be cast for each composite sample. Test one (1) at seven (7) days, two (2) at twenty-eight (28) days and hold one (1) as a spare.

END OF SECTION

SECTION 04 2000

UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick unit masonry.
2. Integral flashings.

B. Related Sections:

1. Division 01: Administrative, procedural, and temporary work requirements.
2. Section 07 9200 - Joint Sealers.

C. Allowances:

1. Include a unit cost allowance of \$450 per 1000 brick for purchase of brick only.
2. Installation is not included in amount of allowance, and is to be included in Contract Sum.

1.2 REFERENCES

A. ASTM International (ASTM):

1. A153/A153M - Standard Specification for Zinc-Coating (Hot Dip) on Iron and Steel Hardware.
2. A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
4. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
5. A951 - Standard Specification for Masonry Joint Reinforcement.
6. C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
7. C90 - Standard Specification for Hollow Loadbearing Concrete Masonry Units.
8. C216 - Standard Specification for Facing Brick (Solid Units Made from Clay or Shale).
9. C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
10. C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Concrete.
11. C1019 - Standard Test Method for Sampling and Testing Grout.

B. The Masonry Society (TMS):

1. 402 - Building Code for Masonry Structures.
2. 602 - Specification for Masonry Structures.

1.3 SUBMITTALS

A. Submittals for Review:

1. Product Data: Provide information on reinforcing and anchors including sizes, profiles, materials, and finishes.
2. Samples: Brick samples in quantities showing full color and texture range.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years experience in work of this Section.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store masonry off ground; prevent contact with materials that could cause staining or damage.
- B. Protect reinforcement and anchors from corrosion.

1.6 PROJECT CONDITIONS

- A. Wall Protection:
 - 1. During erection, cover tops of partially completed walls with strong waterproof membrane at end of each day or work stoppage.
 - 2. Extend cover minimum of 24 inches down both sides; hold securely in place.
- B. Load Application:
 - 1. Do not apply uniform loads for at least 12 hours after building masonry columns or walls.
 - 2. Do not apply concentrated loads for at least 3 days after building masonry columns or walls.
- C. Environmental Requirements:
 - 1. Hot weather requirements: If ambient temperature is over 95 degrees F or relative humidity is less than 50 percent, protect from direct sun and wind exposure for minimum 48 hours after installation.
 - 2. Cold weather requirements: Do not use frozen materials or build on frozen work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Masonry Accessories:
 - 1. Blok-Lok Ltd. (www.blok-lok.com)
 - 2. Dur-O-Wal. (www.dur-o-wal.com)
 - 3. Heckmann Building Products. (www.heckmannbuildingprods.com)
 - 4. Hohmann and Barnard, Inc. (www.h-b.com)

2.2 MATERIALS

- A. Face Brick: To be selected under an allowance.

2.3 ACCESSORIES

- A. Mortar: Specified in Section 04 0513.
- B. Grout: Specified in Section 04 0516.
- C. Single Wythe Joint Reinforcement:
 - 1. Truss type; ASTM A951, hot-dip galvanized steel wire, 9 gage side rods with 9 gage cross ties.
 - 2. Corner and tee fittings: Type to match reinforcement.
- D. Double Wythe Joint Reinforcement:
 - 1. Truss type; ASTM A951, hot-dip galvanized steel wire, 9 gage side rods with 9 gage cross ties.
 - 2. Corner and tee fittings: Type to match reinforcement.
- E. Veneer Ties: Formed steel wire, 3/16 inch thickness, two piece adjustable type with backing plate, hot dip galvanized, ASTM A153/A153M, minimum 2 inch embedment into masonry.
- F. Fasteners: Hot-dip galvanized or Fluoropolymer coated] steel screws, minimum 3/4 inch penetration into substrate.
- G. Reinforcing Bars:

- 1. ASTM A615/A615M, deformed billet steel, Grade 4060.
- H. Flashings: Polyvinyl chloride sheet, min. 30 mils thick.
- I. Flashing Termination Bar: Min. 1" high stainless steel with stainless fasteners
- J. Flashing Support: Min. 24 ga, galvalume metal any locations where flashings span greater than 1.5" wide cavity space.
- K. Weeps: Preformed plastic mesh.
- L. Mortar Dropping Control: Preformed plastic mesh.
- M. Joint Sealer: Specified in Section 07 9200.
- N. Cleaner: Type recommended by masonry manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Wet brick having an absorption rate in excess of 20 g per 30 square inches per minute as determined by ASTM C67 so that absorption rate when laid does not exceed this amount.
- B. Remove dirt, loose rust, and other foreign matter from reinforcement and anchors.

3.2 INSTALLATION

- A. Establish lines, levels and courses indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimensions. Form horizontal and vertical joints of uniform thickness.
- C. Lay brick masonry in running bond unless otherwise indicated. Course three brick units and three mortar joints to equal 8 inches.
- D. Lay masonry plumb and level. Do not adjust masonry units after mortar has set.
- E. Lay solid masonry units in full mortar bed, with full head joints. Lay hollow masonry units with face shell bedding on head and bed joints.
- F. Do not butter corners or excessively furrow joints.
- G. Machine cut masonry with straight cuts and clean edges; prevent oversized or undersized joints. Discard damaged units. Do not expose cut cells.
- H. Isolate masonry from structural members with compressible filler.
- I. When joining fresh masonry to partially set masonry, remove loose masonry and mortar; clean and lightly wet exposed surface of set masonry.
- J. Stop horizontal runs by racking back normal bond unit in each course. Tothing not permitted.
- K. Horizontal Reinforcement:
 - 1. Place reinforcement at maximum 16 inches on center vertically, at topmost course, and at first two courses above and below openings.
 - 2. Extend minimum 24 inches each side of openings.
 - 3. Center reinforcing in wall.
 - 4. Lap ends 6 inches minimum; use fabricated tee and corner fittings at corners and intersections.
- L. Secure masonry to structural members with strap anchors spaced maximum 16 inches on center.

- M. Veneer Ties:
1. Space ties to provide one tie per 1.77 square feet at maximum spacing of 16 inches on center horizontally.
 2. Locate ties within 12 inches of ends of masonry walls and openings.
- N. Control and Expansion Joints:
1. Do not continue horizontal joint reinforcement through joints.
 2. Keep joints free from mortar and grout.
 3. Install joint backing and joint sealer at control joints in accordance with Section 07 9200.
 4. Form expansion joint as indicated on Drawings.
- O. Finishing Mortar Joints:
1. Exposed locations: Tool joints to concave profile.
 2. Concealed locations: Cut joints flush.
- P. Reinforcing Bars:
1. Position reinforcing accurately and hold securely in place to prevent displacement. Maintain minimum 1" space between masonry and reinforcing.
 2. Grout at intervals per structural drawings.
 3. Vibrate grout during and after placement to ensure complete filling.
 4. Stop grout 1-1/2 inch below top of masonry if grouting is stopped for 1 hour or more, except where completing grouting of finished wall.
- Q. Flashings:
1. Install flashing with outer edge flush with outside face of masonry; extend up backup 12 inches minimum and seal.
 2. Lap end joints 4 inches minimum and seal.
 3. Form end dams where flashing is stopped or interrupted.
- R. Weeps:
1. Locate in head joints in first course above flashings at maximum 24 inches on center.
 2. Locate at top of all brick walls to provide air circulation in cavity space.
 3. Set weeps flush with exterior face of masonry.
- S. Install mortar dropping control continuously in cavities above flashings.
- T. Installation Tolerances; Maximum variation from:
1. Alignment of columns and pilasters: Plus or minus 1/4 inch.
 2. Alignment face to face of adjacent units: Plus or minus 1/8 inch.
 3. Vertical alignment of head joints: Plus or minus 1/2 inch in 10 feet.
 4. True plane of wall: Plus or minus 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
 5. Plumb: Plus or minus 1/4 inch in 10 feet noncumulative; 1/2 inch in 20 feet or more.
 6. Level coursing: Plus or minus 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch in 30 feet.
 7. Joint thickness: Plus or minus 1/8 inch.
 8. Cross sectional thickness of walls: Plus or minus 1/4 inch.

3.3 FIELD QUALITY CONTROL

- A. Testing and Inspection Services:
1. Masonry units: Inspect masonry units prior to and during installation for compliance with specified requirements.
 2. Masonry assemblies:
 - a. Determine compressive strength of masonry by the prism method, ASTM C1314.
 - b. Verify dimensions and condition of grout spaces and type, quantity, and placement of reinforcement during installation and just prior to closing of cleanouts.
 - c. Verify type, quantity, and installation of reinforcement, anchors, and ties.
 - d. Inspect placement of grout.

3. Grout: Mold and test one set of compressive strength cubes in accordance with ASTM C1019 for each 200 square feet of masonry wall area or fraction thereof.

3.4 CLEANING

- A. Protect adjacent and underlying surfaces.
- B. Apply masonry cleaner in accordance with manufacturer's instructions.
- C. Thoroughly rinse surfaces with clean water after completion of cleaning; remove all traces of cleaning solution.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes structural steel and grout.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components, including connections, splices, holes, welds, and bolts.
- C. Mill certificates.
- D. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Comply with applicable provisions in AISC's "Specification for Structural Steel Buildings-- Allowable Stress Design and Plastic Design."
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.5 STORAGE AND PROTECTION

- A. Store steel members off ground and protect steel members and packaged materials from erosion and deterioration.
- B. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural-Steel W-Shapes: ASTM A 992, carbon steel domestically produced.
- B. Structural-Steel Cold-Formed Hollow Sections: ASTM A 500 Grade B, carbon steel structural tubing domestically produced.
- C. Structural-Steel Pipe: ASTM A53 Grade B, carbon steel domestically produced.
- D. Structural-Steel Angles, Plates and Bars: ASTM A36, carbon steel domestically produced.
- E. Nonhigh-Strength Anchor Bolts, Nuts, and Washers: ASTM A1554, Grade 36; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.

- F. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type with plain finish.
- G. Primer: Fabricator's standard lead and chromate-free, nonasphaltic, rust-inhibiting primer.
- H. Nonmetallic, Shrinkage-Resistant, Dry-Pack Grout: Premixed, ASTM C 1107, of consistency suitable for application.

2.2 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
 - 1. Comply with fabrication tolerance limits in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
 - 2. Shop install and tighten non-high-strength bolts, except where high-strength bolts are indicated.
 - 3. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - a. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
 - 4. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
- B. Shop Priming: Shop prime steel, except surfaces embedded in concrete or mortar, surfaces to be field welded, surfaces to be high-strength bolted with slip-critical connections, and surfaces to receive sprayed-on fireproofing.
 - 1. Surface Preparation: SSPC-SP 2, "Hand Tool Cleaning."
 - 2. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 ERECTION

- A. Examination: Verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
- B. Erect structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- C. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces before setting base and bearing plates. Clean bottom surface of base and bearing plates and set on wedges, shims, or setting nuts as required.
 - 1. Tighten anchor bolts, cut off wedges or shims flush with edge of base or bearing plate, and pack grout solidly between bearing surfaces and plates.

- D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- E. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
- F. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 1. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
- G. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

END OF SECTION

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work
 - a. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

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.
- B. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 1. Wall Studs: AISI S211.
 2. Headers: AISI S212.
 3. Lateral Design: AISI S213.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: 40,000 psi yield strength for 16 gauge and heavier and 33,000 psi yield strength for 18 gauge and lighter.
 - 2. Coating: G90
- B. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 40,000 psi yield strength.
 - 2. Coating: G90

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch
 - 2. Flange Width 1-5/8 inches
 - 3. Section Properties: as indicated.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch
 - 2. Flange Width: 1-3/8 inches
 - 3. Section Properties: as indicated
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Post-Installed Anchors: As indicated.
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.
- B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, **1/4 inch (6 mm)** thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
- D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- G. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: 16 inches
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **12 inches** of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

END OF SECTION

SECTION 05440

COLD-FORMED METAL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cold-formed steel framing in the form of the following:
 1. Cold-formed steel trusses for roofs.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation conference: conduct conference at project site.

1.3 ACTION SUBMITTALS

- A. Product data: for each type of product.
- B. Shop drawings:
 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.
 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. delegated-design submittal: for cold-formed steel trusses.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Evaluation reports: for post-installed anchors and power-actuated fasteners, from icc-es or other qualified testing agency acceptable to authorities having jurisdiction.
- C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to the following:
 1. [Aegis Metal Framing.](#)
 2. [Marinoware.](#)
 3. [Trussteel; An Itw Company.](#)
 4. [USA Frametek.](#)

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated design: Engage a qualified professional engineer, licensed in the state of Florida, to design cold-formed steel trusses.
- B. Structural performance: provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design loads: as indicated on drawings.
 - 2. Deflection limits: design trusses to withstand design loads without deflections greater than the following:
 - A. Roof Trusses: Vertical deflection of $1/360$ of the span.
 - 3. Design trusses to provide for movement of truss members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
- C. Cold-formed steel truss standards: Unless more stringent requirements are indicated, trusses shall comply with the following:
 - 1. Floor and roof systems: AISI S210.
 - 2. Lateral design: AISI S213.
 - 3. Roof trusses: AISI S214.

2.3 COLD-FORMED STEEL TRUSS MATERIALS

- A. Steel sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: as required by structural performance.
 - 2. Coating: G90 or equivalent.

2.4 Roof trusses

- A. Roof truss members: Manufacturer's standard steel sections.
 - 1. Connecting flange width: 1-5/8 inches, minimum at top and bottom chords connecting to sheathing or other directly fastened construction.
 - 2. Minimum base-metal thickness: 0.0428 inch top and bottom truss chords as indicated.

2.5 TRUSS ACCESSORIES

- A. Fabricate steel-truss accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.
- B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel shapes and clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

- B. Mechanical fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head type: low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing repair paint: ASTM A 780/A 780M.
- B. Shims: load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.
 - 1. Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.
 - 2. Install continuous bridging and permanently brace trusses as indicated on shop drawings and designed according to CFSEI'S technical Note 551E, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses."
- B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.
- C. Install temporary bracing and supports to secure trusses and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to trusses are secured.
- D. Truss spacing: as indicated on drawings.

3.2 ERECTION TOLERANCES

- A. Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual trusses no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: engage a qualified testing agency to perform tests and inspections.
- B. Cold-formed metal trusses will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 Repairs and protection

- A. Galvanizing repairs: prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Shop fabricated metal components.
 - 2. Ladders and safety cages.
 - 3. Guard rails and handrails.

- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.
 - 3. 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 4. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.

- B. American Welding Society (AWS):
 - 1. D1.1/D1.1M - Structural Welding Code - Steel.
 - 2. D1.2/D1.2M - Structural Welding Code - Aluminum.
 - 3. D1.6/D1.6M - Structural Welding Code - Stainless Steel.

- C. ASTM International (ASTM):
 - 1. A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
 - 3. A48/A48M - Standard Specification for Gray Iron Castings.
 - 4. A108 - Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 - 5. A123/A123M - Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
 - 6. A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars.
 - 7. A307 - Standard Specification for Carbon Steel Externally Threaded Standard Fasteners.
 - 8. A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
 - 9. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 10. A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - 11. A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Galvanized Steel.
 - 12. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 13. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 14. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 15. A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 16. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

17. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
18. B241 - Standard Specification for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
19. E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

D. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 503 - Finishes for Stainless Steel.
2. MBG 531 - Metal Bar Grating Manual.

E. Society for Protective Coatings (SSPC) - Painting Manual.

1.3 SYSTEM DESCRIPTION

A. Minimum design loads:

1. Pedestrian loading:
 - a. Uniform load of 100 PSF.
 - b. Concentrated load of 300 pounds.
 - c. Maximum deflection under loading: $L/240$.
2. Guard rails and handrails:
 - a. 50 pounds per linear foot applied in any direction at top, transferred via attachments and supports to building structure.
 - b. Concentrated 200 pound load applied in any direction at any point along top, transferred via attachments and supports to building structure.
 - c. Maximum deflection under loading: $L/120$.
3. Concentrated and uniform loads do not need to be applied simultaneously.
4. Perform design under direct supervision of Professional Structural Engineer licensed in State in which Project is located, with minimum 2 years [documented] experience in work of this Section.

B. Fabricate guard rails and handrails in accordance with ASTM E985.

1.4 SUBMITTALS

A. Submittals for Review:

1. Shop Drawings: Show dimensions, metal thicknesses, finishes, joints, attachments, and relationship of work to adjacent construction.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store steel above ground on platforms, skids, or other supports; separate with wooden separators.
- B. Protect steel from corrosion.
- C. Prevent damage to prime coat and galvanized coatings.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- A. Shapes: ASTM A36/A36M.
- B. Plate: ASTM A283.
- C. Sheet: ASTM A1008/A1008M.

- D. Pipe: ASTM A501.
- E. Tube: ASTM A500.
- F. Bars: ASTM A108.

2.2 MATERIALS - STAINLESS STEEL

- A. Stainless Steel: ASTM A666, Type 304, rollable temper.
- B. Bolts, Nuts and Washers: ASTM A354.

2.3 ACCESSORIES

- A. Exposed Screws: Same material as metal being fastened; Phillips flat head, countersunk, unless noted otherwise.
- B. Bolts: ASTM A307, hexagonal head type.
- C. Primer Paint: SSPC Paint 15, Type 1, red oxide.
- D. Anchoring Cement: Two component epoxy type.

2.4 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of component except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- F. Conceal fastenings where possible.
- G. Welding to conform to AWS D1.1/D1.1M.
 - 1. Use welds for permanent connections where possible. Grind exposed welds smooth.
 - 2. Tack welds prohibited on exposed surfaces.

2.5 FINISHES

- A. Exterior Ferrous Metal: Galvanized; ASTM A123/A123M, to 2.0 ounces per square foot.
- B. Interior Ferrous Metal:
 - 1. Shop painted except steel to be encased in concrete and surfaces to be welded.
 - 2. Surface preparation: SSPC SP2 - Hand Tool Cleaning or SP3 - Power Tool Cleaning.
 - 3. Application: One coat; follow coating manufacturer's instructions.
 - 4. Minimum dry film thickness: 2.0 mils.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install items in accordance with approved Shop Drawings.
- B. Install components plumb, level, and rigid.
- C. Welding: AWS D1.6/D1.6M. Grind and fill exposed welds; finish smooth and flush.
- D. Install sleeved components with anchoring cement.
- E. Prevent contact of exterior aluminum and dissimilar metals by use of zinc rich paint, bituminous coating, or non-absorptive gaskets.

3.2 ADJUSTING

- A. Clean and touch up damaged primer paint with same product as applied in shop.
- B. Clean and touch up galvanized coatings at welded and abraded surfaces in accordance with ASTM A780, Annex A1.

3.3 SCHEDULE

- A. This Schedule includes principal items only; refer to Drawings for additional items not listed.
- B. Guard Rails and Handrails:
 - 1. Fabricate from steel tube stock of sizes and types indicated. Powder coat all exterior handrails and guardrails.
 - 2. Make bends uniform and free from buckles and other defects.
 - 3. Cut intersections square to within 2 degrees and to length within 1/8 inch. Remove burrs from cut ends.
 - 4. Miter and cope intersections within 2 degrees, fit to within 1/8 inch.
 - 5. Continuously weld connections.
 - 6. Where length exceeds that suitable for shipping and handling, fabricate in sections with concealed internal sleeves forming slip joints. Extend sleeves minimum 2 inches on both sides of joint; field weld and grind smooth.
- C. Ladders:
 - 1. Side rails: Continuous steel flat bars, 1/2 x 2-1/2 inches, eased edges, spaced 18 inches apart.
 - 2. Rungs: Round steel bars, 3/4 inch diameter, spaced 12 inches on center. Fit rungs in centerline of side rails and plug weld on outer rail face.
 - 3. Support ladders at top, bottom, and at intermediate points spaced maximum 5'-0" on center with steel brackets, welded or bolted to supports.
- D. Nosings for Exterior Concrete Steps: Cast iron, cross hatched abrasive surface, 1 inch nosing, 4 inches deep x step width less 6 inches.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and furring.
 - 2. Telephone and electrical panel backboards.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Wood Protection Association (AWPA):
 - 1. M4 - Standard for the Care of Preservative Treated Wood Products.
 - 2. U1 - Use Category System - User Specification for Treated Wood.
- B. ASTM International (ASTM):
 - 1. A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
- C. Engineered Wood Association (APA) PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels.
- D. National Institute of Standards and Technology (NIST) - Product Standard PS 20 - American Softwood Lumber Standard.
- E. Southern Pine Inspection Bureau (SPIB) - Standard Grading Rules for Southern Pine Lumber.

1.3 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified to NIST PS 20.
- B. Identify lumber and sheet products by official grade mark.
- C. Fire Retardant Treated Products: Bear label of recognized independent testing laboratory indicating flame spread rating of 25 or less, tested to ASTM E84.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials minimum 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation.
- B. Do not store seasoned or treated materials in damp location.
- C. Protect edges and corners of sheet materials from damage.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Lumber:
 - 1. Grading rules: SPIB.
 - 2. Species: Southern Pine (kiln dried post-treatment)
 - 3. Surfacing: Surfaced four sides (S4S) [unless otherwise indicated].
 - 4. Maximum moisture content: 19 percent.

- B. Sheet Products:
 - 1. Type: APA Plywood.
 - 2. Panel grade: APA
 - 3. Exposure:
 - a. Interior applications: Interior.

2.2 ACCESSORIES

- A. Fasteners:
 - 1. Type and size: As required by conditions of use.
 - 2. Exterior locations and treated products: Hot-dip galvanized steel, ASTM A153/A153M, G90 coating class. Or Stainless steel, ASTM F593, Type 304 or 316.
 - 3. Other interior locations: Plain steel.

2.3 FABRICATION

- A. Preservative Treatment:
 - 1. Treat lumber in accordance with AWWA U1:
 - a. Interior locations protected from moisture sources: Category UC1 - Interior/Dry.
 - b. Interior locations subject to sources of moisture: Category UC2 - Interior/Damp.
 - c. Exterior locations above ground: Category UC3A - Above Ground/Protected.

 - 2. Treatment process: Type [ACQ - Ammoniacal Copper Quaternary (ACQ); free from arsenic, chromium, and other EPA classified hazardous preservatives.

- B. Fire Retardant Treatment; treat lumber and in accordance with AWWA U1:
 - 1. Interior locations: Category UCFA - Fire Retardant/Interior.
 - 2. Exterior locations: Category UCFB - Fire Retardant/Exterior.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide blocking, nailers, grounds, furring, and other similar items required to receive and support work.

- B. Set members level, plumb, and rigid.

- C. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

- D. Install telephone and electrical panel backboards where indicated. Oversize panel by 12 inches on all sides.

- E. Treat field cuts and holes in members providing structural support in accordance with AWWA M4.

END OF SECTION

SECTION 06 1643

GYPSUM SHEATHING

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior gypsum wall sheathing.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C514 - Standard Specification for Nails for the Application of Gypsum Wallboard.
 - 2. C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Board.
 - 1. C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 2. C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel.
 - 3. C1280 - Standard Specification for Application of Gypsum Sheathing Board.
 - 4. C1396 - Standard Specification for Gypsum Board.
 - 5. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Illustrate panel product types, thicknesses, and installation.
- B. Sustainable Design Submittals:
 - 1. Recycled Content.
 - 2. Regional Materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. GP Gypsum Corporation. (www.gp.com)
 - 2. National Gypsum Co. (www.nationalgypsum.com)
 - 3. USG Corporation. (www.usg.com)
 - 4. [____].
 - 5. [____].
 - 6. [____].
- B. Substitutions: [Under provisions of Division 01.] [Not permitted.]

2.2 MATERIALS

- A. Exterior Sheathing:
 - 1. Type: ASTM C1396; [24] [____] inches wide x [[1/2] [5/8] inch thick,] [thickness indicated,] maximum practical length, ends square cut, tongue and groove edges.
 - 2. Recycled content:
 - a. Core: Minimum [____] percent, with minimum [____] percent classified as post consumer.
 - b. Facings: Minimum [____] percent, with minimum [____] percent classified as post consumer.

**** OR ****

B. Exterior Sheathing:

1. Source: [____] by [____] or approved substitute.
2. Type: ASTM C1177/C1177M or ASTM C1278/C1278M; [48] [____] inches wide x [1/2] [5/8] inch thick, [thickness indicated,] maximum practical length, square cut ends and edges.
3. Mold resistance: 10, tested to ASTM D3273.
4. Recycled content: Minimum [____] percent.

2.3 ACCESSORIES

- A. Fasteners: [ASTM C1002, Type [W] [S] screws,] [ASTM C514, drywall nails,] hot-dip galvanized or fluoropolymer coated steel, minimum [5/8] [____] inch penetration into framing.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with ASTM C1280 and manufacturer's instructions.
- B. Accurately cut panels to fit around openings and projections.
- C. Apply panels horizontally, tongue edge up, with ends occurring over supports. Stagger end joints in adjacent rows.

**** OR ****

- D. Apply panels vertically, with ends and edges occurring over supports.
- E. Fasten panels to framing at maximum [8] [____] inches on center. Place fasteners minimum [3/8] [____] inch from edges of panels; drive heads flush with surface. Stagger fasteners at abutting edges.

END OF SECTION

SECTION 06 4100

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Special fabricated cabinet units.
 - 2. Plastic laminate countertops.
 - 3. Cabinet hardware.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 06 6116 - Solid Surfacing Fabrications.
 - 3. Section 07 9200 - Joint Sealers.
 - 4. Section 12 3640 - Stone Countertops.

1.2 REFERENCES

- A. Architectural Woodwork Institute/Architectural Woodwork Manufacturers of Canada/Woodwork Institute (AWI/AWMAC/WI) - Architectural Woodwork Standards.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings:
 - a. Include dimensioned plan, sections, elevations, and details, including interface with adjacent work.
 - b. Designate wood species and finishes.
 - 2. Samples:
 - a. Plastic laminate samples showing available colors and finishes.
 - b. Each hardware component.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Minimum 5 years experience in work of this Section.
 - 2. Certified under AWI/AWMAC/WI Quality Certification Program.
- B. Pre-Installation Conference:
 - 1. Convene 2 weeks prior to beginning work of this Section.
 - 2. Attendance: Architect, Owner, Construction Manager, installer, and related trades.
 - 3. Review, discuss and resolve:
 - a. Critical dimensions.
 - b. Product delivery and storage.
 - c. Staging and sequencing.
 - d. Protection of completed work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver materials until proper protection can be provided, and until needed for installation.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Maintain following conditions in building for minimum 7 days prior to, during, and after installation of casework:
 - 1. Temperature: 60 to 80 degrees F.
 - 2. Humidity: 43 to 70 percent.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Plastic Laminate:
 - 1. Products by following manufacturers are acceptable:
 - a. Formica Corp. (www.formica.com)
 - b. Nevamar Co. (www.nevamar.com)
 - c. Wilsonart International, Inc. (www.wilsonart.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Sheet Products:
 - 1. Graded in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 4 requirements for quality grade specified.
 - 2. Sheet core: Medium density fiberboard.
- B. Lumber:
 - 1. Graded in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 3 requirements for quality grade specified, average moisture content of 6 percent.
- C. Plastic Laminate: NEMA LD-3.
 - 1. High pressure decorative laminate:
 - a. Horizontal surfaces:
 - 1) Backing sheet: Grade BGF.
 - b. Vertical surfaces:
 - 1) Backing sheet: Grade BLF.
 - 2) Cabinet liner: Grade CLS.
 - 3) Other surfaces: Grade VGP.
 - 2. Low pressure decorative laminate: Grade VGL.
 - 3. Colors: To be selected from manufacturer's full color range.
 - 4. Finish: Matte.

2.3 ACCESSORIES

- A. Solid Surfacing Countertops: Specified in Section 06 6116.
- B. Fasteners: Type and size as required by conditions of use.
- C. Adhesives:
 - 1. Waterproof, water based type, compatible with backing and laminate materials.
- D. Finish Hardware: As scheduled at end of Section or approved substitute.
- E. Joint Sealers: Specified in Section 07 9200.

2.4 FABRICATION

- A. Cabinets - Plastic Laminate Finish:
 - 1. Quality: AWI/AWMAC/WI Architectural Woodwork Standards, Section 10, Premium Grade.
 - 2. Construction type: Frameless.
 - 3. Interface style: Flush inset.
 - 4. Semi-exposed surfaces: Low pressure decorative laminate.
 - 5. Fit exposed and semi-exposed sheet edges with matching PVC edging.
 - 6. Fabricate drawer bodies to full depth of drawer fronts less 1/2 inch.
- B. Shop assemble for delivery to project site in units easily handled.
- C. Prior to fabrication, field verify dimensions to ensure correct fit.

- D. Apply plastic laminate in full uninterrupted sheets; fit corners and joints to hairline. Slightly bevel arises. Apply laminate backing sheet to reverse side of laminate faced surfaces.
- E. Where field fitting is required, provide ample allowance for cutting. Provide trim for scribing and site conditions.
- F. Provide cutouts and reinforcement for plumbing, electrical, appliances, and accessories]. Prime paint surfaces of cut edges.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to installation, condition cabinets to average humidity that will prevail after installation.

3.2 INSTALLATION

- A. Install in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
- B. Set plumb, rigid and level.
- C. Scribe to adjacent construction with maximum 1/8 inch gaps.
- D. Adhere countertops, splashes, and skirts with beads of adhesive.
- E. Fill joints between cabinets and adjacent construction with joint sealer as specified in Section 07 9200; finish flush.

3.3 FINISH HARDWARE SCHEDULE

DESCRIPTION	MANUFACTURER	MODEL
Door and drawer pull		
Drawer slide		
Door hinge		
Door hinge		
Cabinet lock		
Adjustable shelf standards and brackets		

END OF SECTION

SECTION 07 1313

BITUMINOUS SHEET WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Self adhering modified bitumen sheet waterproofing.
 - 2. Protection board.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. D412 - Standard Specification for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
 - 2. D570 - Standard Test Method for Water Absorption of Plastics.
 - 3. D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - 4. D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
 - 5. D4261 - Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
 - 6. E96/E96M - Standard Test Method for Water Vapor Transmission of Materials.
 - 7. E154 - Standard Test Method for Water Vapor Retarders Used In Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- B. National Roofing Contractors Association (NRCA) - Waterproofing Manual.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Include termination details and interface with adjacent construction.
 - 2. Product Data: Manufacturer's data for waterproofing and [drainage] [protection] board including product description and performance characteristics.
 - 3. Warranty: Sample warranty form.
- B. Sustainable Design Submittals:
 - 1. Regional Materials.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Minimum [] years [documented] experience in work of this Section.
 - 2. Licensed or certified by waterproofing manufacturer.
- B. Pre-Installation Conference:
 - 1. Convene at site [2] [] weeks prior to beginning work of this Section.
 - 2. Attendance: [Architect,] [Design/Builder,] [Contractor,] [Construction Manager,] waterproofing applicator, waterproofing manufacturer's representative, and related trades.
 - 3. Review and discuss Contract Documents, waterproofing system manufacturer's literature, job conditions, scheduling, and other matters affecting application as appropriate.
 - 4. Tour representative areas of waterproofing substrates, and discuss substrate construction, related items, work conditions, and materials compatibility.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials in enclosed space; protect from weather and direct sun. Maintain temperature range in storage area between [40 to 90] [] to [] degrees F.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Do not apply during inclement weather.
- B. Substrate: Cured minimum [7] [] days.

1.7 WARRANTIES

- A. Furnish [manufacturer's] [applicator's] [5] [] year warranty providing coverage against water leakage through waterproofing system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 1. Carlisle Coatings and Waterproofing. (www.carlisle-ccw.com)
 2. Grace Construction Products. (www.graceconstruction.com)
 3. W.R. Meadows, Inc. (www.wrmeadows.com)
 4. Polyguard Products, Inc. (www.polyguardproducts.com)
 5. [].
 6. [].
 7. [].
- B. Substitutions: [Under provisions of Division 01.] [Not permitted.]

2.2 MATERIALS

- A. Bituminous Sheet Membrane Waterproofing System:
 1. Preformed rubberized asphalt laminated to polyethylene film with release paper facing, self adhering, minimum [60] [] mils thick, [36] [] inch wide rolls.
 2. Physical properties:

PROPERTY	TEST METHOD	RESULTS
Tensile Strength, Film	ASTM D882	Minimum [5,000] [] psi
Tensile Strength, Membrane	ASTM D412	Minimum [250] [] psi
Elongation, Membrane	ASTM D412	Minimum [300] [] percent
Moisture Vapor Permeance	ASTM E96, Method B	Maximum [0.1] [] perms
Puncture Resistance, Membrane	ASTM E154	Minimum [40] [] pounds
Water Absorption, Membrane	ASTM D570	Maximum [0.2] [] percent by weight

2.3 ACCESSORIES

- A. Primers, Mastics, and Liquid Membranes: As recommended by waterproofing system manufacturer.
- B. Patching Compound: Premixed, latex modified Portland cement grout.
- C. Termination Bar: Steel sheet, minimum [22] [] gage core steel, [2] [] inches high, [G90] [] hot-dip galvanized coating.

- D. Fasteners: Hot dip galvanized or fluoropolymer coated steel, type best suited to application.
- E. Joint Sealers: Specified in Section 07 9200.
- F. Drainage Board:
 - 1. Studded, non-biodegradable, molded plastic sheet drainage core with nonwoven, needle-punched geotextile facing laminated to one side and polymeric film bonded to other side.
 - 2. Vertical flow rate: Minimum [9] [] gallons per minute per foot.
 - 3. Thickness: Nominally [1/4] [] inch.
 - 4. Adhesive: Type recommended by drainage board manufacturer.
- G. Protection Board:
 - 1. [Extruded polystyrene with plastic facing both sides, [1/4] [] inch thick.] [Waterproofing manufacturer's standard product.]
 - 2. Adhesive: Type recommended by protection board manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Substrate Preparation:
 - 1. Remove protrusions flush with adjacent surface.
 - 2. Remove loose and spalled concrete.
 - 3. Patch holes and depressions with patching compound; finish flush.
 - 4. Clean surfaces to ASTM [D4258.] [D4261.]

**** OR ****
- B. Clean surfaces; remove loose and foreign matter that could impede adhesion or performance of waterproofing.
- C. Dynamic Cracks and Joints:
 - 1. Remove loose and spalled concrete.
 - 2. Patch holes and depressions with patching compound.
 - 3. Rout out crack or joint to minimum dimensions of [1/4] [] inch deep x [1/2] [] inch wide.
 - 4. Apply sealant to prepared cracks and joints as specified in Section 07 9200.

3.2 INSTALLATION OF WATERPROOFING

- A. Install waterproofing system in accordance with manufacturer's instructions and NRCA Manual.
- B. Apply primer to coverage rate required by manufacturer.
 - 1. Allow to dry until tack free.
 - 2. Cover only that area that will be covered with membrane in same day.
 - 3. Re-apply if left uncovered over 24 hours.
- C. Form 3/4 inch fillet with liquid membrane on inside corners; extend minimum [6] [] inches on both sides of corner at minimum [90] [] mils thick.
- D. Cover static cracks and joints in substrate with minimum [9] [] inch wide membrane strip.
- E. Cover dynamic cracks and joints with minimum [9] [] inch wide membrane strip applied in reverse, with release paper left in place to form bond breaker. Cover that with an [18] [] inch wide strip placed in normal manner.
- F. Cover inside and outside corners with minimum [12] [] inch wide membrane centered over corner.

- G. Apply membrane with minimum [2-1/2] [] inch side and end laps; roll surface to eliminate wrinkles and air spaces.
- H. [Lap top edge of membrane over top of wall.] [Terminate top edge of membrane at grade [and seal with bead of mastic.] [with metal termination bar.]]
- I. Terminate bottom edge of membrane within [1] [] inch of bottom of wall; seal edge with trowel bead of mastic.
- J. Apply membrane on horizontal surfaces starting at low point, laying membrane perpendicular to slope. Weatherlap joints.
- K. Provide double membrane layer minimum [6] [] inches around penetrations; seal with mastic.
- L. If application is not complete at end of work day, seal exposed edges with mastic.

3.3 INSTALLATION OF DRAINAGE BOARD

- A. Apply drainage board same day membrane is applied.
- B. Install in accordance with manufacturer's instructions.
- C. Cut pieces from roll to required length. Cut to fit around penetrations and at perimeter.
- D. Secure sheets to waterproofing membrane with adhesive. Place with filter fabric to earth.
- E. Overlap and secure filter fabric on adjacent sheets.

Include the following when a subsurface drain is used.

- F. Pull filter fabric loose from core at bottom of wall; wrap fabric around subsurface drainage pipe.
- G. Complete backfilling as soon as possible after application of drainage board; within [7] [] days maximum.

3.4 INSTALLATION OF PROTECTION BOARD

- A. Apply protection board same day membrane is applied.
- B. Install in accordance with manufacturer's instructions.
- C. Apply adhesive at rates as recommended by manufacturer; set boards in adhesive with edges butted.
- D. Complete backfilling as soon as possible after application of protection board; within [7] [] days maximum.

3.5 FIELD QUALITY CONTROL

- A. Prior to applying drainage or protection course, inspect surfaces for voids, ruptures, and other damage.
- B. Repair damaged and defective areas.
- C. Horizontal Applications:
 1. Dam areas and flood with minimum [1] [] inch of water prior to applying protection course.
 2. After [24] [] hours, check for leaks. If leaks are encountered, repair and repeat test.
 3. When proven watertight, drain water and remove dams.

END OF SECTION

SECTION 07 2115

BATT INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Batt insulation in interior wall assemblies.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C665 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Wood Frame and Light Construction Buildings.
 - 2. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.

1.3 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.

1.4 QUALITY ASSURANCE

- A. Fire Hazard Classification:
 - 1. Noncombustible, tested to ASTM E136.
 - 2. Flame spread/smoke developed rating of 25/50 or less, tested to ASTM E84.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store insulation in clean, dry, sheltered area, off ground or floor, until used. Protect against wetting and moisture absorption.

1.6 PROJECT CONDITIONS

- A. Do not install insulation until building is substantially water and weather tight.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Johns Manville. (www.jm.com)
 - 2. Knauf Insulation. (www.knaufinsulation.us)
 - 3. Owens Corning. (www.owenscorning.com)

2.2 MATERIALS

- A. **Thermal Batt Insulation:**
 - 1. Type: ASTM C665, glass fiber composition.
 - 2. Facing: [Unfaced.] [[Foil/scrim/Kraft] [White poly/scrim/Kraft] [Kraft paper] vapor barrier on one side.]

3. Stapling flanges: [None.] [Stapling flanges on both edges.]
4. Binder: Rapidly renewable organic product.
5. Fibers: Minimum [] percent recycled content, classified as post-consumer.
6. Free from urea-formaldehyde resins, phenol, acrylics, and artificial colors.

**** OR ****

7. Free from urea-formaldehyde resins.
8. Thermal resistance:
 - a. 3-1/2 inches thick: R-value of 11.00.
 - b. 3-5/8 inches thick: R-value of 13.00.
 - c. 6-1/4 inches thick: R-value of 19.00.
 - d. 6-1/2 inches thick: R-value of 22.0.
 - e. 8-1/2 inches thick: R-value of 25.0.
 - f. 9 inches thick: R-value of 26.0.
 - g. 10 inches thick: R-value of 30.00.
 - h. 12 inches thick: R-value of 38.00.

2.3 ACCESSORIES

- A. Tape: Minimum [2] [] inches wide, pressure sensitive, [foil faced,] waterproof.
- B. Fasteners: Hot-dip galvanized steel [staples,] [nails,] type best suited to application, minimum [5/8] [] inch penetration into framing.
- C. Impale Fasteners: Steel impaling fasteners on metal base with lock washers, length to suit insulation thickness.
- D. Wire Mesh: Hexagonal steel wire, galvanized.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Friction fit between framing members.

**** OR ****

- B. Staple or nail in place at maximum [12] [] inches on center.

**** OR ****

- C. Retain in place with wire mesh secured to framing.

**** OR ****

- D. Place impale fasteners within [4] [] inches of edges of boards and maximum [24] [] inches on center. Apply insulation and secure with lock washers.
- E. Butt insulation to adjacent construction. Butt ends and edges.
- F. Carry insulation around pipes, wiring, boxes, and other components.
- G. Ensure complete enclosure of spaces without voids.
- H. Apply with vapor barrier facing towards [exterior] [interior] of structure.
- I. Tape seal lapped flanges, butt ends, and tears and holes in facings.

END OF SECTION

SECTION 07 2119

SPRAY FOAM INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Foamed-in-place insulation in exterior wall assemblies.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ICC Evaluation Services (ICC) AC 377 - Acceptance Criteria for Spray-Applied Foam Plastic Insulation.
- B. ASTM International (ASTM):
 - 1. C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 2. C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 3. D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
 - 4. D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - 5. D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
 - 6. D2856 - Standard Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer.
 - 7. D6866 -
 - 8. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 9. E96 - Standard Test Methods for Water Vapor Transmission of Materials.
 - 10. E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - 11. E413 - Classification for Rating Sound Insulation.
- C. Underwriters Laboratories of Canada (CAN/ULC):
 - 1. S705.01 - Spray-Applied Rigid Polyurethane Foam Insulation, Medium Density.
 - 2. S102 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- D. International Code Council (ICC):
 - 1. International Building Code.
 - 2. International Residential Code.
- E. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Provide product description, insulation properties, and preparation requirements.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Certified by insulation manufacturer.
 - 2. Minimum 2 years experience in work of this Section.

1.5 PROJECT CONDITIONS

- A. Do not apply insulation when environmental conditions are outside limits required by material manufacturer.

1.6 WARRANTIES

- A. Provide manufacturer's lifetime warranty against defective materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Contract Documents are based on products by Demilec (USA) LLC. (www.demilecusa.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Spray-Applied Semi-Rigid Polyurethane Foam Insulation System:
 - 1. Product: SEALECTION 500.
 - 2. Product Approvals:
 - a. International Code Council Evaluation Services: Report No. 1172.
 - b. Interior finish: Pass NFPA 286 in accordance with IBC 803.2.
 - 1) Up to 10 inches in floors or ceilings and 5-1/2 inches in walls.
 - 2) Covered with 14 dry mils of fire barrier as specified under "Accessories."
 - 3) Thermal barrier and ignition barrier may be omitted.
 - c. Attics and crawlspaces; pass AC 377; compliant NFPA 286:
 - 1) Up to 11-1/2 inches exposed on underside roof deck.
 - 2) Up to 10 inches on vertical surfaces with 10 mil fire barrier as specified under "Accessories."
 - d. Tested to CAN/ULC S102: Warnock Hersey Evaluation No. 193-7081.
 - 3. Physical Properties:
 - a. Density: 0.45 to 0.5 PCF, tested to ASTM D1622.
 - b. Thermal resistance:
 - 1) R-value of 3.81 per inch, tested 2 days at 76 degree F to ASTM C518.
 - 2) R-value of 3.81 per inch, tested 90 days at 76 degree F to ASTM C518.
 - c. Air leakage; tested to ASTM E 283:
 - 1) 3.5 inches at 75 Pa: 0.001 L/S/SQ M.
 - 2) 5.5 inches at 75 Pa: 0.001 L/S/SQ M.
 - 3) 10 inches at 75 Pa: 0.002 L/S/SQ M.
 - 4) Sustained wind load for 60 minutes at 1000 Pa: No damage.
 - 5) Gust wind load test at 3000 Pa: No damage.
 - d. Compressive strength: 0.7 PSI, tested to ASTM D1621.
 - e. Tensile Strength : 5.6 LBF/SQ IN, tested to ASTM D1623.
 - f. Sound transmission class (STC): 49 to 51, tested to ASTM E413.
 - g. Noise reduction coefficient (NRC): 75, tested to ASTM C423.
 - h. Water vapor transmission; tested to ASTM E 96:
 - 1) 3.5 inches: 6.6 perms.
 - 2) 5.5 inches: 4.2 perms.
 - 3) 7 inches: 3.3 perms.
 - 4) 10 inches: 2.3 perms.
 - i. Off-gassing (VOC emissions): No toxic vapors, tested to CGSB 51.23.
 - j. Surface burning characteristics: Class I, tested to ASTM E84.

2.3 ACCESSORIES

- A. Water-Based Fire Barrier:
 - 1. Product: BLAZELOK IB manufactured by TPR².
 - 2. Product approval: Comply with 2006 IRC 314.6, 2009 IRC 316.6, IBC 2603.9, and AC 377 for use over spray-applied polyurethane foam insulation on vertical surfaces for use without prescriptive ignition barrier in attics and crawlspaces.
 - 3. Physical properties:
 - a. Surface burning characteristics: Class I, tested to ASTM E84.
 - b. Expands up to 2000 percent.
 - c. Flash point: None.
 - d. Volatility/VOC: 0.
 - e. Flexible, ductile, and elastomeric.
 - f. Non-toxic, drain safe, water-based, non-fuming.
 - g. Accepts latex and oil base paint top coats.
 - 4. Color: Gray.
- B. Water Based Fire Protection:
 - 1. Product: BLAZELOK TB manufactured by TPR².
 - 2. Approval: Comply with 2006 IRC 314.6, 2009 IRC 316.6, IBC 2603.9, and IBC 803.2 over spray-applied polyurethane foam insulation for use without prescriptive thermal barrier.
 - 3. Physical properties:
 - a. Surface burning characteristics: Class I, tested to ASTM E84.
 - b. Expands up to 2000 percent.
 - c. Flash Point: None.
 - d. Volatility/VOC: Less than 50 G/L.
 - e. Non-toxic, drain safe, water-based, non-fuming.
 - f. Accepts latex and oil base paint top coats.
 - g. Color: Dull grayish white.

2.4 EQUIPMENT

- A. Application Equipment: fixed ratio positive displacement pump type, approved by foam insulation manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Protect adjacent surfaces from accidental application.
- B. Prepare surfaces to receive insulation as required by manufacturer based on substrate.

3.2 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by froth method, to uniform monolithic density without voids.
- C. Apply fire barrier to insulation in accordance with manufacturer's instructions.

3.3 ADJUSTING

- A. Patch damaged areas.

END OF SECTION

SECTION 07 2200

ROOF INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rigid roof insulation.
 - 2. Cover board.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- B. ASTM International (ASTM):
 - 1. C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 2. C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel.
 - 1. C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 2. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- C. Factory Mutual Insurance Co. (FM) Property Loss Prevention Data Sheet 1-28 - Design Wind Loads.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Design roofing system to resist minimum wind loads in accordance with ASCE 7 and net uplift loads as designated on structural drawings.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's descriptive data including thermal values.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 5 years experience in work of this Section.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect materials against moisture absorption, direct sunlight, damage, and temperatures above 110 degrees F and below 40 degrees F.
- B. Store materials off ground or roof deck on pallets. Cover materials stored outside with breathable covering, properly vented.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers- Insulation:
 - 1. Atlas Roofing Corporation. (www.atlasroofing.com)
 - 2. Hunter Panels. (www.hpanels.com)
 - 3. Rmax. (www.rmaxinc.com)
- B. Acceptable Manufacturers – Cover Board:
 - 1. GP Gypsum Corporation. (www.gp.com)
 - 2. National Gypsum
- C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Rigid Roof Insulation:
 - 1. Type: ASTM C1289, Type II, rigid polyisocyanurate faced both sides with glass fiber mat facings.
- B. Cover Board:
 - 1. Type: ASTM C1177/C1177M or ASTM C1278/C1278M; 48 inches wide x 1/2 inch thick, maximum practical length, square cut ends and edges.
 - 2. Mold resistance: 10, tested to ASTM D3273.

2.3 ACCESSORIES

- A. Fasteners: Hot-dip galvanized or fluoropolymer coated steel, type and length suited to project conditions, with galvanized steel plates.

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION

- A. Apply base layer] with long edges continuous and perpendicular to deck ribs.
- B. Stagger end joints in adjacent rows.
- C. Locate ends over solid bearing.
- D. Apply top layer with long edges perpendicular to those of base layer, with joints staggered in adjacent rows. Offset joints from those in base layer.
- E. Leave 1/4 inch expansion space at panel ends and edges.
- F. Mechanically fasten to substrate in manufacturer's recommended fastening pattern.
- G. Fit insulation to other boards and at perimeter and around penetrations with maximum 3/8 inch voids.

3.2 INSTALLATION OF COVER BOARD

- A. Apply panels with long edges continuous and perpendicular to direction of insulation. Stagger end joints in adjacent rows. Offset joints from those in insulation.

- B. Mechanically fasten to substrate in manufacturer's recommended fastening pattern.
- C. Fit sheathing to other boards and at perimeter and around penetrations with maximum 3/8 inch voids.

3.3 TOLERANCES

- A. Surface Flatness of Insulation: Plus or minus 1/4 inch in 10 feet maximum.

END OF SECTION

SECTION 07 2400

EXTERIOR INSULATION AND FINISH SYSTEM

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Moisture barrier.
 - 2. Composite wall cladding of rigid insulation and applied coating.
 - 3. Trim and accessories.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American National Standards Institute/EIFS Industry Manufacturers Association (ANSI/EIMA) 99A - Exterior Insulation and Finish Systems.
- B. ASTM International (ASTM):
 - 1. C578 - Standard Specification for Preformed Cellular Polystyrene Thermal Insulation.
 - 2. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. E2098 - Standard Test Method for Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution.
- C. EIFS Industry Manufacturers Association (EIMA) - Classification Paper.

1.3 SYSTEM DESCRIPTION

- A. System Classification: EIMA Class [PM.] [PB, [Standard] [Intermediate] [High] [Ultra High] impact resistance.]
- B. Fire Hazard Classification: Maximum flame spread/smoke developed rating of [25/450,] [__,] tested to ASTM E84.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate joint layout and dimensions, system penetration details, and termination details.
 - 2. Product Data: Include primary and secondary product descriptions, application instructions, performance criteria, and list of sealants approved for use with system.
 - 3. Samples:
 - a. [3 x 3] [__ x __] inch finish coat samples showing available colors.
 - b. [After color selection, submit] [24 x 24] [__ x __] inch samples showing proposed system, including insulation, reinforcing, and finish coat in proposed color and texture.
 - c. [6] [__] inch long trim samples.
 - 4. Warranty: Sample warranty form.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance:
 - a. Manufacturer's certification that installed system complies with requirements of Contract Documents.
 - b. Certificate of approval by Code authorities having jurisdiction over Project.
 - c. Certification from an independent testing laboratory that system meets fire hazard classification requirements.

1.5 QUALITY ASSURANCE

- A. Furnish EIFS system components from single manufacturer.
- B. Manufacturer Qualifications: Minimum [5] years [documented] experience in work of this Section.
- C. Installer Qualifications: Minimum [] years [documented] experience in work of this Section.
- D. Mockup:
 - 1. Size: Minimum [4 x 8] [] x [] feet.
 - 2. Show insulation, [trim,] [base coat], reinforcement, and finish.
 - 3. Include [roof parapet,] [window] [] opening and related flashings, base flashings, joint sealers, and penetrations.
 - 4. Locate [where directed.] [].
 - 5. Approved mockup may [not] remain as part of the Work.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store adhesives and coatings in protected, dry area until used, at temperature between [40 and 90] [] to [] degrees F.

1.7 PROJECT CONDITIONS

- A. Do not apply adhesives and coatings if:
 - 1. Ambient temperature is below [40] [] degrees F, or is expected to fall below that temperature within [24] [] hours after application.
 - 2. Relative humidity is above [85] [] percent and surface temperature is lower than [5] [] degrees F below dew point.
 - 3. Wind velocity is over [20] [] MPH.

1.8 WARRANTIES

- A. Furnish [manufacturer's] [applicator's] [10] year warranty providing coverage against air and water leakage through EIFS system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. BASF Wall Systems, Inc. (www.wallsystems.basf.com)
 - 2. Dryvit System, Inc. (www.dryvit.com)
 - 3. Parex, Inc. (www.parex.com)
 - 4. Sto Corp. (www.stocorp.com)
- B. Substitutions: [Under provisions of Division 01.] []

2.2 MATERIALS

- A. Moisture Barrier: Fluid-applied type; system manufacturer's standard product equal to "Synersshield" by Synergy.
- B. Adhesive: Acrylic based; type recommended by system manufacturer.
- C. Base Coat: Acrylic modified portland cement, glass fiber reinforced; type recommended by system manufacturer.

- D. Finish Coat: EIMA Class [PB; [vinyl composition,] [polymer base,]] [Class PM; polymer modified portland cement containing chopped glass fibers,] [medium] [____] texture, [custom] [____] color [to be selected from manufacturer's full color range].
- E. Rigid Insulation:
 - 1. ASTM C578, Type [I, molded]] [VI, closed cell extruded] polystyrene [, slotted on back side for drainage].
 - 2. Edges: Square.
 - 3. Minimum thickness: 2 inches.
 - 4. Thermal resistance: Minimum R value of [____].
- F. Reinforcing: Glass fiber mesh, balanced open weave, alkaline resistant, treated for improved bond with coating, tested to ASTM E2098 and classified to EIMA impact classification.
 - 1. Standard impact mesh: Minimum [4.5] [____] ounces per square yard.
 - 2. Intermediate impact mesh: Minimum [10.0] [____] ounces per square yard.
 - 3. High impact mesh: Minimum [14.0] [____] ounces per square yard.
 - 4. Ultra high impact mesh: Minimum [20.0] [____] ounces per square yard.
 - 5. Corner mesh: Minimum [20.0] [____] ounces per square yard.

2.3 ACCESSORIES

- A. Trim:
 - 1. [Extruded PVC,] perforated attachment flanges, of longest practical length.
 - 2. Corner bead: Beaded edge, size and profile to suit application.
 - 3. Casing bead: Thickness governed by system thickness, square edge.
 - 4. Drainage casing: Thickness governed by system thickness, square edge, perforated for drainage.
 - 5. Control joint: Accordion profile with minimum [2] [____] inch flanges each side, with attachment flanges.
- B. Insulation Fasteners: Hot-dip galvanized or fluoropolymer coated steel with minimum [1] [____] inch diameter washers, minimum [5/8] [____] inch penetration into framing, of type recommended by system manufacturer.
- C. Trim Fasteners: Hot-dip galvanized or fluoropolymer coated steel, type recommended by system manufacturer.
- D. Water: Clean and potable.

2.4 MIXES

- A. [Base and] Finish Coat: In accordance with manufacturer's instructions.

PART 3 EXECUTION

3.1 APPLICATION OF MOISTURE BARRIER

- A. Apply moisture barrier in accordance with manufacturer's instructions.
- B. Apply moisture barrier by roller to continuous and uniform coverage with minimum mil thickness as recommended by manufacturer.
- C. Completely joint compound applied at cracks, joints, perimeter, and penetrations with moisture barrier.

3.2 APPLICATION OF INSULATION AND REINFORCING

- A. Install system in accordance with ANSI/EIMA 99A and manufacturer's instructions.

- B. Install insulation [horizontally,] [vertically,] [in most economical manner,] with joints offset joints from those in substrate. Stagger end joints in adjacent rows minimum [12] [__] inches. Cut panels to fit at perimeter and around penetrations.
- C. Mechanically fasten insulation to framing at maximum [16] [__] inches on center.
- D. Apply reinforcing with minimum [3] [__] inch end and side laps. Secure to framing at maximum [16] [__] inches. Wrap exposed edges.
- E. Trowel apply base coat over reinforcing to [1/8] [1/4] [__] inch minimum thickness.
- F. After base coat dries, sand high areas to provide smooth, level surface.
- G. Install trim in accordance with manufacturer's instructions:
 1. Install corner beads at external corners.
 2. Install casings where finish system abuts dissimilar material or stops with edge exposed [, except at bottom edges].
 3. [Install drainage casing [at wall base] [at each floor line] [and] [over openings in walls].]
 4. Rout slots in insulation board at control joint locations; install control joint over slots.
 5. Seal corners and intersections.

**** OR ****

3.3 APPLICATION OF INSULATION AND REINFORCING

- A. Install system in accordance with ANSI/EIMA 99A and manufacturer's instructions.
- B. Install insulation [horizontally,] [vertically,] [in most economical manner,] with joints offset joints from those in substrate. Stagger end joints in adjacent rows minimum 12 inches. Cut panels to fit at perimeter and around penetrations.
- C. Adhere insulation to substrate with beads of adhesive.

**** OR ****

- D. Mechanically fasten insulation to framing at maximum [16] [__] inches on center.
- E. Apply minimum [1/16] [__] inch layer of adhesive over insulation board.
- F. Fully embed reinforcement in adhesive, wrinkle free.
- G. Lap ends and edges [2] [__] inches minimum.
- H. Wrap reinforcement and adhesive around insulation edge at reveals, control joints and where system abuts dissimilar materials or stops with edge exposed [, except at bottom edges].
- I. Install heavy mesh up to [10] [__] feet above grade or paving.
- J. Install corner mesh for minimum [12] [__] inches on both sides of external corners.
- K. Install drainage casing [at wall base] [at each floor line] [and] [over openings in walls]. Seal corners and intersections.

3.4 APPLICATION OF INSULATION AND REINFORCING

- A. Install system in accordance with ANSI/EIMA 99A and manufacturer's instructions.
- B. Adhere insulation to substrate with full adhesive bed applied using notched trowel, with drainage channels running vertically.

1. Install insulation [horizontally,] [vertically,] [in most economical manner,] with joints offset joints from those in substrate.
 2. Stagger end joints in adjacent rows minimum 12 inches.
 3. Cut panels to fit at perimeter and around penetrations.
 4. Press to full contact with adhesive without restricting drainage behind panels.
- C. Apply minimum [1/16] [] inch layer of adhesive over insulation board.
- D. Fully embed reinforcement in adhesive, wrinkle free.
- E. Lap ends and edges [2] [] inches minimum.
- F. Wrap reinforcement and adhesive around insulation edge at reveals, control joints and where system abuts dissimilar materials or stops with edge exposed [, except at bottom edges].
- G. Install heavy mesh up to [10] [] feet above grade or paving.
- H. Install corner mesh for minimum [12] [] inches on both sides of external corners.
- I. Install drainage casing [at wall base] [at each floor line] [and] [over openings in walls]. Seal corners and intersections.

3.5 APPLICATION OF FINISH COAT

- A. Apply in accordance with manufacturer's instructions.
- B. Work in continuous operation in each panel formed by trim and intersections to ensure even texture.
- C. Cut edges in clean and sharp where work joins other materials.
- D. Apply to uniform texture and color without streaks, laps, heavy buildups, and missed areas.
- E. Ensure consistent application and uniform appearance.

3.6 ADJUSTING

- A. Touch up finish coat as required to obtain uniform texture.

END OF SECTION

SECTION 07 2800

MOISTURE BARRIERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fluid applied materials for controlling moisture movement at exterior wall assemblies.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. E96/E96M - Standard Test Method for Water Vapor Transmission of Materials.
 - 2. E331 - Standard Test Method for Water Penetration of Exterior Windows, Doors, and Curtain Walls by Uniform Static Air Pressure Differential.
 - 3. E2178 - Standard Test Method for Air Permeance of Building Materials.
 - 4. E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.3 QUALITY ASSURANCE

- A. Provide continuous barrier to moisture infiltration, air infiltration and exfiltration, and water vapor transmission, flashed to discharge incidental condensation and water penetration.
- B. Mockup:
 - 1. Construct mockup of typical exterior wall, minimum 8 feet wide x 8 feet high.
 - 2. Incorporate back-up construction, moisture barrier, typical opening, flashings, and critical junctions.
 - 3. Locate where directed.
 - 4. Approved mockup may remain as part of the Work.
- C. Pre-Installation Conference:
 - 1. Convene at site 2 weeks prior to beginning work of this Section.
 - 2. Attendance: Architect, Contractor, moisture barrier installer, and related trades whose work follows or affects moisture barrier.
 - 3. Review and discuss:
 - a. Surface preparation, minimum substrate curing period, and installation procedures.
 - b. Special details and flashings.
 - c. Sequence of construction, responsibilities, and schedule for subsequent operations.
 - d. Mock-up requirements.
 - e. Inspection, protection, and repair procedures.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's descriptive data.
 - 2. Samples: 12 x 12 inch moisture barrier samples.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Fluid Applied Moisture Barriers:

1. Design Basis: Contract Documents are based on products by Prosoco R-Guard Cat 5 Rain screen.

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Moisture Barrier:

1. Source: Prosoco R-Guard Cat 5 Rain screen.
2. Type: Fluid applied, water based, roller grade,
3. Elongation: Minimum 1000 percent, tested to ASTM D412.
4. Water vapor transmission: Maximum 0.02 grains per square foot, tested to ASTM E96/E96M.
5. Air permeance: Maximum 0.0002 CFM per square foot at 3 inch water differential pressure, tested to ASTM E2178.
6. Assembly air permeance: Maximum 0.0008 CFM per square foot at 0.3 inch water differential pressure, tested to ASTM E2357.
7. Water leakage: None, tested to ASTM E331 at minimum 6.24 PSF.

2.3 ACCESSORIES

A. Primer: Type recommended by moisture barrier manufacturer.

B. Patching Compound: Type recommended by moisture barrier manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive moisture barrier; remove loose and foreign matter that could impair adhesion or performance.

B. Protect adjacent and underlying surfaces.

C. Fill voids, holes, and cracks over 1/16 inch in width with patching compound; finish flush with adjacent surfaces. Apply one coat of moisture barrier over patched areas and allow to dry.

D. Apply joint tape centered over sheathing joints. Lap ends 2 inches minimum Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.

3.2 APPLICATION - FLUID APPLIED MOISTURE BARRIERS

A. Apply moisture barrier in accordance with manufacturer's instructions.

B. Apply primer to joints in substrate, inside and outside corners, and around perimeter and penetrations. Apply joint tape over primer; press to full bond with substrate.

C. Apply moisture barrier by roller or spray to continuous and uniform coverage with minimum mil thickness as recommended by manufacturer.

D. Seal to door and window frames, around penetrations, and at perimeter with flashing sheet. Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.

3.3 FIELD QUALITY CONTROL

A. Inspect moisture barrier for damage just prior to covering.

B. Clean damaged areas and cover with additional moisture barrier material minimum 6 inches larger than damaged area on all sides.

END OF SECTION

SECTION 07 5400

THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mechanically fastened single ply membrane roofing.
 - 2. Base flashings.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 06 1000 - Rough Carpentry.
 - 3. Section 07 6200 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

- A. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- B. ASTM International (ASTM):
 - 1. C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - 2. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 3. D4434 - Standard Specification for Poly (Vinyl Chloride) Sheet Roofing.
 - 4. D6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
 - 5. E108 - Standard Test Methods for Fire Tests of Roof Coverings.
 - 6. E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- C. Energy Star - Qualified Products.
- D. Factory Mutual Insurance Co. (FM):
 - 1. 4470 - Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction.
 - 2. Property Loss Prevention Data Sheet 1-28 - Design Wind Loads.
 - 3. Property Loss Prevention Data Sheet 1-49 - Perimeter Flashing.
- E. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Design roofing system to resist minimum wind loads in accordance with ASCE 7 and net uplift loads as indicated in structural drawings.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate:
 - a. Setting plan for insulation.
 - b. Roof slopes.
 - c. Layout of seams.
 - d. Base flashing, termination, and special details.
 - e. Fastener types and locations.
 - 2. Product Data: Manufacturer's product specifications, installation instructions, and general

- recommendations for each product.
 - 3. Samples:
 - a. Fastener plate. Batten strip, 12 inch long.
 - b. Walkway pad.
 - 4. Warranty: Sample warranty form.
- B. Quality Control Submittals:
- 1. Certificates of Compliance: Certification from an independent testing laboratory that roofing system meets fire hazard and windstorm classification requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
- 1. Minimum 10 years experience in work of this Section.
 - 2. Licensed or certified by roofing materials manufacturer.
- B. Roofing System:
- 1. Green Globes qualified for project location; bear Energy Star label.
 - 2. Solar Reflectance Index: Minimum 78, tested to ASTM C1549 and calculated in accordance with ASTM E1980.
- C. Pre-Installation Conference:
- 1. Convene at site 2 weeks prior to beginning work of this Section.
 - 2. Attendance: Architect, Contractor, roofing applicator, roofing manufacturer's representative, and related trades.
 - 3. Review and discuss: Contract Documents, roofing system manufacturer's literature, project conditions, scheduling, and other matters affecting application.
 - 4. Tour representative areas of roofing substrates; discuss substrate construction, related work, work conditions, and materials compatibility.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store materials, other than membrane, in protected, dry area, between 60 and 80 degrees F until used; provide proper ventilation.
- B. Protect sheet goods from damage and wetting.

1.7 PROJECT CONDITIONS

- A. Do not apply roofing to damp or frozen substrate.
- B. Do not apply roofing during inclement weather or at temperatures below 40 degrees F, or above 100 degrees F or if freezing weather is anticipated within 24 hours after application. Do not use frozen materials.

1.8 WARRANTIES

- A. Furnish manufacturer's 10 year warranty providing coverage against water leakage through roofing system.
- 1. Make repairs to roofing system required due to defects in materials or workmanship resulting in water leakage into or through roofing system.
 - 2. Include cost of labor and materials necessary to make required repairs.
 - 3. Cover all roofing system components including roofing membrane, built-up and metal flashings, high wall waterproof flashings, roof insulation, and preflashed accessories.
 - 4. Not limited to specific dollar amount.
 - 5. Transferable to subsequent building owners during warranty period.
 - 6. Include coverage for wind speeds up to 120 MPH.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - PVC Roofing System:
 - 1. Design Basis: Contract Documents are based on products by Carlisle PVC.
- B. Acceptable Manufacturers - TPO Roofing System:
 - 1. Design Basis: Contract Documents are based on products by Carlisle Syntec.
 - 2. Equivalent products by following manufacturers are acceptable:
- C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Rigid Insulation:
 - 1. Type: ASTM C1289, Type II, rigid polyisocyanurate faced both sides with glass fiber mat facings.
 - 2. Thermal resistance: Minimum R value as indicated on drawings.
 - 3. Provide board tapered to 1/4 inch per foot.
- B. Cover Board:
 - 1. Type: ASTM C1177/C1177M or ASTM C1278/C1278M; 48 inches wide x 1/2 inch thick, maximum practical length, square cut ends and edges.
 - 2. Mold resistance: 10, tested to ASTM D3273.
- C. Roof Membrane: (Base Bid)
 - 1. Type: ASTM D4434, plasticized polyvinyl chloride (PVC), ultraviolet resistant, reinforced.
 - 2. Size: Maximum sheet size permitted by application and job conditions.
 - 3. Thickness: 60 mils.
 - 4. Color: White.
- D. Roof Membrane: (Alternate System)
 - 1. Type: ASTM D6878, thermoplastic polyolefin (TPO), ultraviolet resistant, reinforced.
 - 2. Size: Maximum sheet size permitted by application and job conditions.
 - 3. Thickness: 60 mils.
 - 4. Color: White.
- E. Flashing Sheet: Manufacturer's standard flashing sheet, color to match membrane.

2.3 ACCESSORIES

- A. Batten Strips or Fastener Plates: Manufacturer's standard.
- B. Accessories:
 - 1. By manufacturer of roofing system, including adhesives, tapes, solvents, sealants, water cutoff mastic, and prefabricated pipe flashings.
- C. Fasteners: Hot-dip galvanized or fluoropolymer coated steel, approved by roofing system manufacturer, type and length suited to project conditions.
- D. Insulation Fasteners: Hot-dip galvanized or fluoropolymer coated steel, approved by roofing system manufacturer, type and length suited to project conditions, with galvanized steel plates.
- E. Nailers and Curbs:
 - 1. Preservative treated wood, specified in Section 06 1000.
 - 2. Nailers: 5-1/2 inch face dimension x insulation thickness.
- F. Metal Flashings: Specified in Section 07 6200.

- G. Metal Flashings (for PVC membrane): Minimum 24 gage sheet metal laminated with PVC membrane.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove projections that could puncture membrane from substrate.
- B. Clean substrate of loose and foreign material, oil, and grease.
- C. Complete roof penetrations and preparation for drains, flashings, and other penetrations prior to beginning roofing.
- D. Protect adjacent and underlying surfaces.

3.2 INSTALLATION - GENERAL

- A. Install roofing system in accordance with roofing system manufacturer's instructions, NRCA Manual, and approved Shop Drawings.

3.3 INSTALLATION OF INSULATION

- A. Apply base layer with long edges continuous and perpendicular to deck ribs. Stagger end joints in adjacent rows.
- B. Apply top layer with long edges perpendicular to those of base layer, with joints staggered in adjacent rows. Offset joints from those in base layer.
- C. Mechanically fasten to substrate in approved fastening pattern.
- D. Fit insulation to other boards and at perimeter and around penetrations with maximum 1/4 inch voids.

3.4 INSTALLATION OF COVER BOARD

- A. Apply panels with long edges continuous direction of insulation. Stagger end joints in adjacent rows. Offset joints from those in insulation. Locate ends over solid bearing.
- B. Mechanically fasten to substrate in manufacturer's recommended fastening pattern.
- C. Fit panels to other panels and at perimeter and around penetrations with maximum 1/4 inch voids.

3.5 INSTALLATION OF ROOF MEMBRANE

- A. Position sheets without stretching; minimize wrinkles. Allow membrane to relax before proceeding.
- B. Provide minimum 5-1/2 inch lap at joints between adjacent sheets.
- C. Splice sheets by heat welding method.
- D. Attach membrane to decking with batten strips or fastener plates.
- E. Fasten membrane to perimeter nailers with fasteners spaced 6 inches on center maximum.
- F. Daily Seal:
 - 1. Ensure that water does not flow beneath completed sections of roof.
 - 2. Temporarily seal loose edge of membrane with night seal when weather is threatening.
 - 3. When work is resumed, pull sheet free before continuing installation.

3.6 INSTALLATION OF FLASHINGS

- A. Construct in accordance with roofing system manufacturer's standard details.
- B. Juncture of Horizontal and Vertical Surfaces:
 - 1. Use longest practical length flashing to minimize joints.
 - 2. Complete splice between flashing and main roof sheet before bonding flashing to vertical surface. Extend splice 3 inches beyond fasteners that attach membrane to horizontal surface.
 - 3. Adhere flashing to substrate with full bed of adhesive.
 - 4. Fasten top of flashing at 12 inches on center maximum, under metal flashing.
- C. Penetrations through Membrane:
 - 1. Flash pipe with premolded pipe flashings wherever possible.
 - 2. Where molded pipe flashings cannot be installed, use field fabricated pipe seals.
 - 3. Seal clusters of pipes and unusually shaped penetrations with minimum 2 inch high flashing containing pourable sealer.
- D. Roof Drains:
 - 1. Taper insulation around drain to provide smooth transition from roof surface to drain clamping ring.
 - 2. Seal between membrane and drain base with water cutoff mastic.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal flashings and trim.
 - 2. Copings.
 - 3. Gutters, scuppers, conductor heads and downspouts.
 - 4. Counterflashings over membrane roof base flashings.
 - 5. Counterflashings at roof mounted equipment and utility penetrations.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.
 - 3. 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 4. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
- B. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI) ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- C. ASTM International (ASTM):
 - 1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 4. A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 5. B32 - Standard Specification for Solder Metal.
 - 6. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- D. Sheet Metal and Air Conditioning Manufacturer's Association International (SMACNA) - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show locations, types and thicknesses of metal, profiles, dimensions, fastening methods, provisions for expansion and contraction, and joint details.
 - 2. Samples:

- a. Each flashing and trim profile, minimum 12 inches long. Include corners where applicable.
- b. 3 x 3 inch prefinished metal samples showing available colors.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Design, fabricate, and install metal copings in accordance with ANSI/SPRI ES-1.
- C. Conform to SMACNA Manual for nominal sizing of gutters, scuppers, collector boxes and downspouts for rainfall intensity determined by a storm occurrence of 1 in 100 years.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Precoated Aluminum-Zinc Alloy Coated Steel Sheet:
 1. ASTM A792/A792M, Commercial Quality, AZ50 aluminum-zinc alloy coating, 24 gage core steel unless noted otherwise.
 2. Finish: AAMA 621, fluoropolymer coating, containing minimum 70 percent PVDF resins, color to be selected from manufacturer's full color range.
- B. Aluminum Sheet:
 1. ASTM B209, alloy 3003, temper H14, [0.026] [0.032] [] inch thick.
 2. Finish: AAMA 611, Architectural Class I anodized, medium bronze color.

2.2 ACCESSORIES

- A. Solder: ASTM B32.
- B. Fasteners: Hot-dip galvanized steel, or Stainless steel, with neoprene gasketed washers where exposed.
- C. Joint Sealers: Specified in Section 07 9200.

2.3 FABRICATION

- A. Fabricate components in accordance with [SMACNA Manual.] [CDA Handbook.]
- B. Profiles:
 1. Gutters: SMACNA
 2. Downspouts: SMACNA
 3. Fabricate end caps, downspout outlets and headers, straps, brackets, and downspout strainers in profile to suit gutters and downspouts.
- C. Fabricate corners in single units with minimum 18 inch long legs.
- D. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

- E. Form sections accurate to size and shape, square and free from distortion and defects.
- F. Provide for thermal expansion and contraction in sheet metal:
 - 1. Gutters:
 - a. Place expansion joints at maximum 50 feet on center.
 - b. Locate expansion joints between downspouts; prevent water flow over joint.
 - 2. Other sheet metal:
 - a. Place expansion joints at 10 feet on center maximum and maximum 2 feet from corners and intersections.
 - 3. Joint width: Consistent with types and sizes of materials, minimum width 1/4 inch.
- G. Fabricate expansion joints in metal copings with backing and cover plates formed to flashing profile, minimum 8 inches long.
- H. Unless otherwise indicated, provide minimum 3/4 inch wide flat lock seams; lap in direction of water flow.
- I. Fabricate cleats and starter strips of same material as sheet metal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install flashing and sheet metal as indicated and in accordance with SMACNA Manual.
- B. Install cleats and starter strips before starting installation of sheet metal. Fasten at 6 inches on center maximum.
- C. Expansion Joints in Metal Copings:
 - 1. Center backing plate between flashing pieces at end joints.
 - 2. Apply two continuous beads of joint sealer between backing plate and flashing sections at each end.
 - 3. Install flashing pieces with 1/2 inch expansion space at abutting ends; apply sealer to expansion space.
 - 4. Apply two continuous beads of joint sealer between cover plate and flashing sections at each end.
- D. Secure flashings with concealed fasteners where possible.
- E. Apply plastic cement between metal and bituminous flashings.
- F. Fit flashings tight, with square corners and surfaces true and straight.
- G. Seam and seal field joints.
- H. Separate dissimilar metals with bituminous coating or non-absorptive gaskets.
- I. Reglets:
 - 1. Install reglets true to line and level. Seal top of surface mounted reglet with joint sealer.
 - 2. Install flashings into reglets to form tight fit. Secure with lead or plastic wedges at 9 inches on center maximum. Seal remaining space with joint sealer.
- J. Gutters: Secure with straps spaced maximum 36 inches on center and within 12 inches of ends.
- K. Downspouts:

1. Secure with straps spaced maximum 8 feet on center and within 2 feet of ends and elbows.
2. Flash downspouts into gutters and conductor heads and fasten.
3. Flash upper sections into lower sections minimum 2 inches at joints; fasten sections together.

L. Apply joint sealers as specified in Section 07 9200.

3.2 CLEANING

A. Clean sheet metal; remove slag, flux, stains, spots, and minor abrasions without etching surfaces.

END OF SECTION

SECTION 07 6500
FLEXIBLE FLASHINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rubberized asphalt sheet for concealed wall flashings
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM) D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's descriptive data and installation instructions.

1.4 PROJECT CONDITIONS

- A. Do not apply flashings at ambient or surface temperatures less than 40 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Grace Construction Products. (www.graceconstruction.com)
 - 2. W.R. Meadows, Inc. (www.wrmeadows.com)
 - 3. Polyguard Products, Inc. (www.polyguardproducts.com)
- B. Substitutions:[Under provisions of Division 01.

2.2 MATERIALS

- A. Rubberized Asphalt Flashings:
 - 1. Description: ASTM D1970; minimum 32 mil thick butyl rubber modified asphalt laminated to 8 mil thick cross-laminated HDPE film, release paper facing, self adhering.
 - 2. Source: "PermaBarrier" by W.R. Grace or approved substitute.

2.3 ACCESSORIES

- A. Termination Mastic: Type recommended by flashing manufacturer.
- B. Termination Bar: Stainless steel metal bar attached to substrate with stainless fasteners.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide flexible flashings in exterior wall assemblies at:

1. Base of walls.
 2. Heads of openings in walls.
 3. Top of walls under copings.
 4. Transitions between materials.
 5. Around openings and penetrations through walls.
- B. Lap ends 4 inches minimum.
- C. Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.
- D. Roll ends and edges with hand held roller; ensure tight seal.
- E. Install termination bar at top of all flexible flashing to substrate.
- F. Apply trowel coat of mastic along flashing at top edge, seams, cuts, and penetrations.

END OF SECTION

SECTION 07 71 00

ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal Copings.
 - 2. Roof-edge flashings.
 - 3. Metal reglets and counterflashings.
 - 4. Miscellaneous sheet metal accessories.

1.2 PERFORMANCE REQUIREMENTS

- A. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified.
 - 1. 8-inch square samples of specified sheet materials to be exposed as finished surfaces.
 - 2. 12-inch long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.
- D. Product test reports.
- E. Maintenance data.
- F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site

1.5 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FABRICATED UNITS

- A. Exposed Metals: General Metal Fabrication – Shop-fabricate work to greatest extent possible. Comply with details shown with applicable requirements of SMACNA “Architectural Sheet Metal Manual” and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - 1. Surface: Smooth, flat finish.
 - 2. Mill Finish: As manufactured.
 - 3. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-coat fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
- C. Stainless-Steel Sheet: ASTM 240/A 240 M or ASTM A 666, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM 653/A 653M, G90 (Z275) coating designation.
 - 1. Surface: Smooth, flat finish.
 - 2. Exposed Coil-Coated Finishes: Prepainted by the coil-coating process to comply with ASTM A 555/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing less than 70 percent PVDF resin by weight.
 - b. Three-coat fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight. Color: As selected by Architect from manufacturer's full range to match adjacent prefinished metal components.

2.2 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, G90 (Z275) coating designation.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip- resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Prefinished gasketed, screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet (3.6 m) concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ATAS International, Inc.
 - b. Merchant & Evans, Inc.
 - c. MM Systems Corporation.
2. Coping-Cap Material: Formed aluminum, thickness as required to meet performance requirements
 - a. Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
3. Corners: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
5. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
6. Face Leg Cleats: Concealed, continuous stainless steel.

2.6 ROOF-EDGE FLASHINGS

- A. One-Piece Gravel Stops: Manufactured, on-piece, metal gravel stop in section lengths not exceeding 12 feet, with a horizontal flange and vertical leg fascia terminating in a drip edge, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ATAS International, Inc.
 - b. Merchant and Evans, Inc.
 - c. MM Systems Corporation.
 2. Fabricate from the following exposed metal:
 - a. Formed Aluminum: Thickness as required to meet performance requirements.
 - b. Zinc-Coated Steel: Nominal thickness as required to meet performance requirements.
 3. Corners: Factory mitered and continuously welded
 4. Aluminum Finish: Two-coat fluoropolymer.
 5. Zinc-Coated Steel Finish: Two-coat fluoropolymer
 - a. Color: As selected by the Architect from manufacturer's full range.
 6. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 - a. Formed aluminum: 0.050 inch thick.
 - b. Stainless Steel 0.025 inch thick.
 - c. Zinc-Coated Steel: Nominal 0.028 inch thickness.
 - d. Corners: Factory mitered and mechanically clinched and sealed watertight.

- e. Surface-mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - f. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
 - g. Multiuse Type, Embedded: For multiuse embedment in masonry mortar joints.
7. Counterflashing: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
- a. Formed Aluminum: 0.024 inch thick.
 - b. Stainless Steel: 0.025 inch thick.
 - c. Zinc-Coated Steel: Nominal 0.028 inch thickness.
8. Accessories:
- a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
 - c. Aluminum Finish: Two-coat fluoropolymer, color as selected by architect from manufacturer's full range.
 - d. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished).
 - e. Zinc-Coated Steel Finish: Two-coat fluoropolymer, color as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
- 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Install underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm). Roll laps of self-adhering sheet underlayment with roller; cover within 14 days.

- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.2 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to meet performance requirements.
 - 1. Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.3 ROOF-EDGE FLASHING INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.4 REGLET AND COUNTERFLASHING INSTALLATION

- A. Embedded Reglets: Coordinate with Division 04 Section "Unit Masonry" for installation of reglets in mortar joints.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Fit counterflashings tightly to base flashings.

3.5 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 roof specialties are installed.

END OF SECTION 07 71 00

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SECTION 07 8400

FIRESTOPPING

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Firestopping perimeter of and penetrations through fire rated assemblies.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops.
 - 2. E1966 - Standard Test Method for Fire-Resistive Joint Systems.
 - 3. E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-Story Test Apparatus.
- B. Underwriters Laboratories, Inc. (UL):
 - 1. 1479 - Fire Tests of Through-Penetration Firestops.
 - 2. 2079 - Fire Resistance of Building Joint Systems.

1.3 SYSTEM DESCRIPTION

- A. Provide continuous protection against passage of heat, fire, smoke, and gases at perimeter of and penetrations through rated assemblies.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data:
 - a. Firestopping schedule; prepare in tabular format and identify:
 - 1) Type of assembly receiving firestop and required fire rating.
 - 2) Type of penetrating item.
 - 3) Proposed firestop system.
 - b. Include UL or equivalent details for each firestop system.
 - 2. Test Reports: Indicate conformance with ASTM E814, ASTM E1966, ASTM E2307, UL 1479, or UL 2079.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Indicate conformance of installed systems with specified requirements.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Minimum 5 years experience in work of this Section.
- B. Firestopping: Fire resistance rating of 1 hour; tested to ASTM E814, ASTM E1966, ASTM E2307, UL 1479, or UL 2079.

1.6 PROJECT CONDITIONS

- A. Do not apply sealants, mortars, or putties when temperature of substrate material and surrounding air is below 40 degrees F or is anticipated to drop below that temperature within 24 hours after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Hilti, Inc. (www.us.hilti.com)
 - 2. 3M Fire Protective Products. (www.3m.com)
 - 3. Rectorseal. (www.rectorseal.com)
 - 4. Specified Technologies, Inc. (www.stifirestop.com)
 - 5. Tremco, Inc. (www.tremcosealants.com)

2.2 MATERIALS

- A. Firestopping: One or more of the following:
 - 1. Silicone elastomer compound: Single or multiple component, low modulus, moisture curing silicone sealant.
 - 2. Ceramic sealant: Single component, moisture curing ceramic sealant.
 - 3. Intumescent sealant: Single component, water based intumescent sealant.
 - 4. Acrylic sealant: Single component acrylic sealant, suitable for painting.
 - 5. Putty: Single component ceramic fiber base putty or intumescent elastomer putty that expands on exposure to surface heat gain.
 - 6. Mortar: Hydraulic cementitious mortar.
 - 7. Pillows or blocks: Formed intumescent or mineral fiber pillows or blocks.
 - 8. Intumescent strips: Solvent free intumescent wrap strips.
 - 9. Mechanical devices: Incombustible fillers or silicone elastomer covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 - 10. Cast-in-place devices: Containing intumescent material and smoke/water seals.

2.3 ACCESSORIES

- A. Forming and Damming Materials: As recommended by firestopping manufacturer for intended use.
 - 1. Permanent: Mineral fiber board, mineral fiber matting, or mineral fiber putty.
 - 2. Temporary: Plywood, particle board, or other.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare openings to receive firestopping as directed by manufacturer:
 - 1. Remove incidental and loose materials from penetration opening.
 - 2. Remove free liquids and oil from involved surfaces and penetration components.
 - 3. Install damming materials to accommodate and ensure proper thickness and fire rating requirements and provide containment during installation.
 - 4. Remove combustible materials and materials not intended for final penetration seal system.

3.2 INSTALLATION

- A. Install firestopping at perimeter of and penetrations through fire rated assemblies.
- B. Apply materials in accordance with manufacturer's instructions.
- C. Apply firestopping material in sufficient thickness to achieve required ratings.
- D. Compress fibered material to achieve a density of 40 percent of its uncompressed density.

- E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- F. Place intumescent coating in sufficient coats to achieve rating required.
- G. Remove dam material after firestopping material has cured.
- H. Finish exposed surfaces to smooth, flush appearance.

END OF SECTION

SECTION 07 9200

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joint backup materials.
 - 2. Joint sealers.

- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
 - 2. C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
 - 3. C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.
 - 4. C834 - Standard Specification for Latex Sealing Compounds.
 - 5. C919 - Standard Practice for Use of Sealants in Acoustical Applications.
 - 6. C920 - Standard Specification for Elastomeric Joint Sealants.
 - 7. C1193 - Standard Guide for Use of Joint Sealants.
 - 8. C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.
 - 9. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - 10. C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
 - 11. D2203 - Standard Test Method for Staining from Sealants.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Indicate sealers, primers, backup materials, bond breakers, and accessories proposed for use.
 - 2. Samples:
 - a. 1/2 x 1/2 x 3 inch long joint sealer samples showing available colors.
 - b. 6 inch long joint backup material samples.
 - 3. Warranty: Sample warranty form.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Minimum 5 years documented experience in work of this Section.

- B. Laboratory Pre-Construction Testing:
 - 1. Obtain representative samples of actual substrate materials.
 - 2. Test sealers and accessories for following:
 - a. Adhesion: Test to ASTM C794 and ASTM C719; determine surface preparation and required primer.
 - b. Compatibility: Test to ASTM C1087; determine that materials in contact with sealers do not adversely affect sealant materials or sealant color.
 - c. Staining: Test to ASTM D2203, ASTM C510, or ASTM C1248; determine that sealants will not stain joint substrates.

- d. Pre-construction testing is not required when sealant manufacturer furnishes data acceptable to Architect based on previous testing for materials matching those of this Project.

A. Field Pre-Construction Testing:

1. Perform field testing for sealant adhesion in accordance with ASTM C1521 on exterior mockup, prior to beginning application, and for each 1000 feet of installed sealer.
2. Install sealers using joint preparation methods and materials recommended by sealer manufacturer.
3. When tests indicate sealant adhesion failure, modify joint preparation, primer, or both and retest until joint passes sealant adhesion test.

1.2 PROJECT CONDITIONS

- A. Do not apply sealers at temperatures below 40 degrees F unless approved by sealer manufacturer.

1.3 WARRANTIES

- A. Furnish manufacturer's 10 year warranty providing coverage for exterior sealers and accessories that fail to provide air and water tight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. BASF Building Systems. (www.buildingsystems.basf.com)
2. Dow Corning Corp. (www.dowcorning.com)
3. GE Silicones. (www.siliconeforbuilding.com)
4. Pecora Corp. (www.pecora.com)
5. Sika Corp. (www.sikausa.com)
6. Tremco, Inc. (www.tremcosealants.com)

- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Joint Sealer Type 1:

1. ASTM C920, Grade NS, single component silicone type, nonstaining, non sag.
2. Movement capability: Plus or minus 25 percent.
3. Color: To be selected from manufacturer's full color range.

B. Joint Sealer Type 2:

1. ASTM C920, Grade NS, single component butyl rubber type, non sag.
2. Movement capability: Plus or minus 12-1/2 percent.
3. Color To be selected from manufacturer's full color range.

C. Joint Sealer Type 3:

1. ASTM C834, single component acrylic latex, non sag.
2. Movement capability: Plus or minus 7-1/2 percent.
3. Color: White.

D. Joint Sealer Type 4:

1. ASTM C920, Grade NS, single component silicone, non sag, mildew resistant.
2. Movement capability: Plus or minus 25 percent.
3. Color: To be selected from manufacturer's full color range.

E. Joint Sealer Type 5:

1. ASTM C834, single component acrylic latex, non sag, non-hardening, non-corrosive, recommended by manufacturer for acoustical applications.
2. Movement capability: Plus or minus 7-1/2 percent.
3. Color: White.

2.3 ACCESSORIES

- A. Primers, Bondbreakers, and Solvents: As recommended by sealer manufacturer.
- B. Joint Backing:
 1. ASTM C1330, closed cell polyethylene foam, preformed round joint filler, non absorbing, non staining, resilient, compatible with sealer and primer, recommended by sealer manufacturer for each sealer type.
 2. Size: Minimum 1.25 times joint width.

2.4 MIXES

- A. Mix multiple component sealers in accordance with manufacturer's instructions.
 1. Mix with mechanical mixer; prevent air entrainment and overheating.
 2. Continue mixing until color is uniform.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove loose and foreign matter that could impair adhesion. If surface has been subject to chemical contamination, contact sealer manufacturer for recommendation.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Protect adjacent surfaces with masking tape or protective coverings.
- D. Sealer Dimensions:
 1. Minimum joint size: 1/4 x 1/4 inch.
 2. Joints 1/4 to 1/2 inch wide: Depth equal to width.
 3. Joints over 1/2 inch wide: Depth equal to one half of width.

3.2 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Install sealers and accessories in accordance with ASTM C1193.
- C. Install acoustical sealers and accessories in accordance with ASTM C919.
- D. Install joint backing to maintain required sealer dimensions. Compress backing approximately 25 percent without puncturing skin. Do not twist or stretch.
- E. Use bondbreaker tape where joint backing is not installed.
- F. Fill joints full without air pockets, embedded materials, ridges, and sags.
- G. Tool sealer to smooth profile.
- H. Apply sealer within manufacturer's recommended temperature range.

3.3 CLEANING

- A. Remove masking tape and protective coverings after sealer has cured.

B. Clean adjacent surfaces.

3.4 SCHEDULE

JOINT LOCATION OR TYPE

SEALER TYPE

Exterior Joints:

Joints in above-grade surfaces

2

Interior Joints:

Joints in acoustical assemblies

5

Other joints

3

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hollow steel doors and frames.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 08 7100 - Door Hardware.
 - 3. Section 08 8000 - Glazing.

1.2 REFERENCES

- A. American National Standards Institute (ANSI)/Steel Door Institute (SDI):
 - 1. A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finished Painted Steel for Steel Doors and Frames.
 - 2. A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
 - 3. A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 4. A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. A250.11 - Recommended Erection Instructions for Steel Frames.
- B. ASTM International (ASTM):
 - 1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 3. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 4. C518 - Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 5. E413 - Classification for Rating Sound Insulation.
- C. National Fire Protection Association (NFPA) 80 - Standard for Fire Doors and Fire Windows.
- D. Steel Door Institute (SDI) 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
- E. Underwriters Laboratories (UL):
 - 1. 10B - Standard for Fire Tests of Door Assemblies.
 - 2. 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show locations, elevations, dimensions, model designations, fire, thermal ratings, preparation for hardware, and anchoring details.
 - 2. Product Data: Show elevations, dimensions, gages of metal, hardware reinforcing gages and locations, and anchor types.

- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification that products furnished comply with ANSI/SDI A250.3, ANSI/SDI 250.4, and ANSI/SDI A250.10.

1.4 QUALITY ASSURANCE

- A. Doors: ANSI/SDI A250.8.
 - 1. Grade: III - Extra Heavy Duty.
 - 2. Model: 1A - Full Flush.
 - 3. Exterior doors: Maximum thermal transmittance (U-value) of 0.50, tested to ASTM C518.
- B. Frames: ANSI/SDI A250.8, Grade III - Extra Heavy Duty.
- C. Fire Door and Frame Construction: Conform to UL 10B.
- D. Installed Fire Rated Door and Frame Assemblies: Conform to NFPA 80.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Ship door frames with removable angle spreader; do not remove until frame is installed.
- B. Store doors upright in protected, dry area, off ground or floor, with at least 1/4 inch space between individual units.
- C. Do not cover with non vented coverings that create excessive humidity.
- D. Remove wet coverings immediately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Ceco Door. (www.cecodoor.com)
 - 2. Curries. (www.curries.com)
 - 3. Pioneer Industries, Inc. (www.pioneerindustries.com)
 - 4. Steelcraft. (www.steelcraft.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Galvanized Steel Sheet:
 - 1. ASTM A653/A653M, hot dipped, Structural Quality, Class G40 galvanized.
- B. Galvannealed Steel Sheet:
 - 1. ASTM A924, Class A40 galvannealed.
- C. Door Core:
 - 1. Exterior doors: Foamed-in-place polyurethane insulation
 - 2. Interior temperature-rise rated doors: Rigid mineral fiberboard Interior fire-rated and non-fire rated doors: Resin impregnated fibrous honeycomb.

2.3 ACCESSORIES

- A. Glass, Glazing Sealers, and Accessories: Specified in Section 08 8000.
- B. Primer: Zinc rich type.

2.4 FABRICATION

- A. Fabricate doors and frames in accordance with ANSI/SDI A250.8.
- B. Fabricate exterior doors and frames from galvanized or galvanized steel sheet.
- C. Fabricate exterior frames with 3/8 inch vinyl thermal break separating interior and exterior surfaces.
- D. Doors:
 - 1. Fabricate from minimum 14 gage sheets.
 - 2. Close top and bottom edges of doors with steel channel, minimum 16 gage, extending full width of door, and spot welded to both faces, with top channel flush and bottom channel recessed.
 - 3. Fill voids between vertical steel stiffeners with batt insulation.
 - 4. Fabricate vertical door edges as vertical seam edge filled, dressed smooth, intermittently welded seams, edge filled, dressed smooth, or continuously welded seam, dressed smooth.
- E. Frames:
 - 1. Fabricate from minimum 14 gage sheets.
 - 2. Close corner joints tight with trim faces mitered and face welded, full profile welded, or continuously welded and ground smooth.
 - 3. Anchors:
 - a. Provide one anchor at each jamb for each 30 inches of door height.
 - b. Design anchors to provide positive fastenings to adjacent construction.
 - c. Provide one floor anchor welded to each jamb.
 - 4. Where frames will be filled with concrete or grout, install silencers in frames before erection.
- F. Accurately form to required sizes and profiles.
- G. Grind and dress exposed welds to form smooth, flush surfaces.
- H. Do not use metallic filler to conceal manufacturing defects.
- I. Fabricate with internal reinforcement for hardware specified in Section 08 7100; weld in place.
- J. Design Clearances:
 - 1. Between door and frame: Maximum 1/8 inch.
 - 2. Between meeting edges of pairs of doors:
 - a. Non-fire rated doors: 3/16 inch plus or minus 1/16 inch.
 - b. Fire-rated doors: 1/8 inch plus or minus 1/16 inch.
 - 3. Undercut:
 - a. Non-fire rated doors: Maximum 3/4 inch.
 - b. Fire-rated doors: Comply with NFPA 80.
 - 4. Between face of door and stop: 1/16 to 3/32 inch.
- K. Manufacturing Tolerances: In accordance with SDI-117.

2.5 FINISHES

- A. Dress tool marks and surface imperfections to smooth surfaces.
- B. Clean and chemically treat steel surfaces.
- C. Touch up damaged metallic coatings.
- D. Apply manufacturer's standard rust inhibiting primer paint, air-dried or baked on, meeting requirements of ANSI/SDI A250.10.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors and frames in accordance with ANSI/SDI A250.11.
- B. Set plumb and level.
- C. Secure to adjacent construction using fastener type best suited to application.
- D. Install glass as specified in Section 08 8000.
- E. Install hardware in accordance with Section 08 7100.

3.2 ADJUSTING

- A. Touch up minor scratches and abrasions in primer paint to match factory finish.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood veneer faced flush doors.
 - 2. Factory finishing.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 08 7100 - Door Hardware.
 - 3. Section 08 8000 - Glazing.

1.2 REFERENCES

- A. Architectural Woodwork Institute/Architectural Woodwork Manufacturers of Canada/Woodwork Institute (AWI/AWMAC/WI) - Architectural Woodwork Standards.
- B. ASTM International (ASTM) E90 - Standard Test Method for Measurement of Airborne-Sound Transmission Loss of Building Partitions.
- C. National Fire Protection Association (NFPA) 80 - Standard for Fire Doors and Fire Windows.
- D. Underwriters Laboratories (UL):
 - 1. 10B - Standard for Fire Tests of Door Assemblies.
 - 2. 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
- E. Window and Door Manufacturers Association (WDMA) - I.S.1A - Industry Standard for Architectural Flush Wood Doors.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show locations, elevations, dimensions, [fire] [acoustical] ratings, and preparation for hardware.
 - 2. Samples:
 - a. 6 x 6 inch door samples showing edges, core, and faces.
 - b. 12 x 12 inch veneer samples showing specified stain color and finish.
 - 3. Warranty: Sample warranty form.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Manufacturer's certification that doors comply with specified acoustical requirements.

1.4 QUALITY ASSURANCE

- A. Fire Door Construction: Conform to UL 10B.
- B. Installed Fire Rated Door Assembly: Conform to NFPA 80.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Package doors in heavy plastic with identifying marks; slit plastic wrap on site to permit ventilation, but do not remove from plastic until ready to install.

- B. Do not deliver doors until building is substantially water and weather tight.
- C. Store doors flat and level, with spacers between doors to allow for air circulation, in protected, dry area.
- D. Environmental Requirements: Maintain following conditions in building for minimum 7 days prior to, during, and after installation of doors:
 - 1. Temperature: 60 to 80 degrees F.
 - 2. Humidity: 43 to 70 percent.

1.6 WARRANTIES

- A. Furnish manufacturer's 5 year warranty providing coverage against defects in materials and workmanship and warpage beyond specified amount.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Algoma Hardwoods, Inc. (www.algomahardwoods.com)
 - 2. Eggers Industries. (www.eggersindustries.com)
 - 3. Marshfield DoorSystems, Inc. (www.marshfielddoors.com)
 - 4. Oshkosh Door Co. (www.oshkoshdoor.com)
 - 5. VT Industries, Inc. (www.vtindustries.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Flush Wood Doors:
 - 1. AWI/AWMAC/WI Architectural Woodwork Standards, Section 9.
 - 2. Core type:
 - a. Solid, fire rated: Fire-Resistant Composite Core.
 - b. Solid, non rated: Particleboard or Medium Density Fiberboard.
 - c. Hollow: Hollow Grid.
 - 3. Wood veneers faces: Red Oak species, rift cut, of quality suitable for transparent finish.
 - 4. Glazing beads: Solid wood of species and cut to match face veneers.
 - 5. Adhesives: Water Resistant type.

2.3 ACCESSORIES

- A. Glass and Glazing Accessories: Specified in Section 08 8000.

2.4 FABRICATION

- A. Fabricate doors in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 9.
 - 1. Grade: Premium.
 - 2. Performance Level: Heavy Duty.
 - 3. Edge Type: Solid wood.
 - 4. Number of plies: 5.
- B. Prefitting; fit doors to frames at factory with following clearances:
 - 1. Fire rated doors:
 - a. Width: Cut lock edge only; 3/16 inch maximum.
 - b. Height: Cut bottom edge only; 1 inch maximum.
 - 2. Non-rated doors:

- a. Width: Cut hinge and lock edges equally.
- b. Height: Cut bottom edge only; maximum 3/4 inch.
- 3. Edge clearances:
 - a. Jambs and head: 1/8 inch maximum between door and frame.
 - b. Sills without thresholds: 1/8 inch maximum between door and top of finish floor.
 - c. Sills with thresholds: 1/4 inch maximum between door and top of threshold.
 - d. Meeting stiles of pairs: 1/8 inch maximum between doors.
- 4. Lock edge: Bevel 1/8 inch in 2 inches.

C. Premachining: Machine doors at factory to receive hardware specified in Section 08 7100.

2.5 FINISHES

- A. Factory Finishing:
 - 1. Factory finish doors in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5.
 - 2. Color: To be selected from manufacturer's full color range.
 - 3. Sheen: Satin.

PART 3 EXECUTION

3.1 PREPARATION

- A. Condition doors to average humidity that will be encountered after installation.

3.2 INSTALLATION

- A. Install doors in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
- B. Install doors plumb and level.
- C. If field cutting for height is necessary, cut bottom edge only, 3/4 inch maximum.
- D. Seal field cut surfaces with same finish as door faces.
- E. Install door hardware in accordance with Section 08 7100.
- F. Install glass as specified in Section 08 8000.
- G. Installation Tolerances:
 - 1. Warp: Maximum 1/4 inch in any 3'-0" x 7'-0" portion of door, measured with taut string or straight edge on concave face of door.

END OF SECTION

SECTION 08 4113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum entrance doors and frames.
 - 2. Aluminum framed glazed storefronts.
 - 3. Glass infill panels.
 - 4. Door hardware.

- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.
 - 3. Section 08 7100 - Door Hardware.
 - 4. Section 08 8000 - Glazing.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - 3. 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.
 - 4. 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 5. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.

- B. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA) A156.3 - Exit Devices.

- C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

- D. ASTM International (ASTM):
 - 1. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. E283 - Standard Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.
 - 4. E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors under the Influence of Wind Loads.
 - 5. E331 - Standard Test Method for Water Penetration of Exterior Windows, Doors, and Curtain Walls by Uniform Static Air Pressure Differential.
 - 6. E547 - Standard Test Method for Water Penetration of Exterior Windows, Doors, and Curtain Walls by Cyclical Static Air Pressure Differential.
 - 7. E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 - 8. E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

- E. Underwriters Laboratories (UL) 305 - Safety Panic Hardware.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Design [exterior] systems to withstand:
 - 1. Design wind pressure in accordance with structural drawings with maximum allowable deflection of $L/175$, tested in accordance with ASTM E330.
 - 2. Movement caused by an ambient temperature range of 120 degrees F and a surface temperature range of 160 degrees F.
- B. Performance Requirements:
 - 1. Air infiltration, tested to ASTM E283.
 - a. Entrances:
 - 1) Single door: Maximum 0.5 CFM per minute per linear foot of perimeter crack, at static pressure differential of 6.24 PSF.
 - 2) Pairs of doors: Maximum 1.0 CFM per minute per linear foot of perimeter crack, at static pressure differential of 6.24 PSF.
 - b. Storefront: 0.06 CFM per square foot of fixed area at static pressure differential of 6.24 PSF.
 - 2. Water infiltration: No uncontrolled water leakage, tested to ASTM E331 at minimum test pressure of 15.0 PSF for outswing doors and storefront.
 - 3. Uniform structural loading: No glass breakage or permanent damage to fasteners or system components, tested to ASTM E330 at 1.5 times design pressure.
 - 4. Thermal transmittance due to conduction (U_c): Maximum 0.60, tested to AAMA 1503 on two 6'-0" x 6'-0" units with 1 inch clear insulating glass.
 - 5. Condensation resistance factor (CRF): Minimum 50, tested to AAMA 1503.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, trim, sealers, hardware, and accessories.
 - 2. Samples:
 - a. 12 inch long aluminum framing system samples showing profile and finish.
- B. Quality Control Submittals:
 - 1. Test Reports: Certified results of previous tests by a recognized independent laboratory substantiating compliance with specified design and performance criteria, current within past 5 years.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years experience in work of this Section.
- B. Conform to applicable accessibility code for locating hardware and for door opening force requirements.

1.6 WARRANTIES

- A. Furnish manufacturer's 10 year warranty providing coverage against water leakage through storefront system and reduction of performance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. EFCO Corporation. (www.efcocorp.com)
 - 2. Kawneer Co., Inc. (www.kawneer.com)
 - 3. Oldcastle Building Envelope. (www.oldcastlebe.com)
 - 4. Tubelite, Inc. (www.tubeliteinc.com)

5. YKK AP America, Inc. (www.ykkap.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Aluminum:
 1. Extrusions: ASTM B221, 6063-T5 alloy and temper.
 2. Sheet: ASTM B209, alloy and temper best suited to application.

2.3 COMPONENTS

- A. Entrances Doors: Medium stile configuration with nominal 3-1/2 inch vertical stiles and top rail and 6-1/2 inch bottom rail.
- B. Storefront: Flush glazing system designed to receive 1-5/16 inch glass by means of elastomeric gaskets and/or wet sealant; 2-1/2 inch face width x 5 inch depth, center multi-plane glass application.
- C. Door Hardware:
 1. Butt hinges: Manufacturer's standard, full mortise, five knuckle, ball bearing type with non rising pins. Provide non-removable pins at exterior outswinging doors.
 2. Closers:
 - a. Overhead exposed, single acting, adjustable closing and latching speed and backcheck, 105 degree hold open.
 - b. Adjustable opening force and delayed closing in accordance with applicable accessibility code.
 3. Deadlocks: Keyed outside x thumb turn inside; cylinders specified in Section 08 7100.
 4. Push and pull: To be selected from manufacturer's full range of selections.
 5. Thresholds: 1/2 inch high, aluminum, saddle profile, handicap accessible.
 6. Door stops: Floor mounted; aluminum housing with resilient bumper.

2.4 ACCESSORIES

- A. Fasteners:
 1. Series 300 stainless steel for wet locations and exposed fasteners.
 2. Stainless or fluoropolymer coated steel for other locations.
- B. Joint Sealers: Specified in Section 07 9200.
- C. Glass and Glazing Accessories: Specified in Section 08 8000.
- D. Weatherstripping: Replaceable, resilient bulb type.

2.5 FABRICATION

- A. Fabricate with minimal clearances and shim spaces around perimeter.
- B. Accurately fit and secure joints and intersections. Make joints flush, hairline, and weathertight.
- C. Fabricate in largest practical units.
- D. Conceal fasteners and attachments from view.
- E. Fabricate fascias, covers, closures, flashings, and trim members from same material as storefront.
- F. Doors:
 1. Through bolted construction.

2. Provide weatherstripping at door head, jambs, meeting stiles, and sills.
3. Prepare with internal reinforcements for door hardware.

2.6 FINISHES

- A. Aluminum: AAMA 611, Architectural Class I anodized to 0.0007 inch minimum thickness, clear color.
- B. Apply bituminous coating to aluminum surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Install components plumb and level, in proper plane, free from warp and twist.
- C. Anchor to supporting construction.
- D. Set thresholds and sill members exposed to weather in mastic and secure.
- E. Install hardware using templates provided by manufacturer.
- F. Install glass and accessories in accordance with Section 08 8000.
- G. Installation Tolerances:
 1. Maximum variation from plumb or level: 1/8 inch in 3 feet or 1/4 inch in any 10 feet, whichever is less.
 2. Maximum misalignment of members abutting end to end: 1/32 inch.
 3. Sealant space between framing members and adjacent construction: 1/2 inch plus or minus 1/8 inch.

3.2 FIELD QUALITY CONTROL

3.3 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Adjust doors to operate with maximum opening forces in accordance with applicable accessibility code.
- C. Touch up minor scratches and abrasions to match original finish.
- D. Adjust weatherstripping to contact appropriate surfaces and form weather seal.

END OF SECTION

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Commercial Mechanical door hardware for the following:
 - a. Swinging doors.
- B. Related Sections include the following:
 - 1. Division 08 Section "Hollow Metal Doors and Frames"
 - 2. Division 08 Section "Flush Wood Doors"
 - 3. Division 08 Section "Fiberglass Reinforced Polyester Doors"
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
 - 1. Permanent cores to be installed by Owner.

1.3 SUBMITTALS

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.
 - 1. Samples will be returned to Contractor. Units that are acceptable through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- C. Qualification Data: For Installer and Architectural Hardware Consultant.
- D. Product Test Reports: If requested by the Architect provide reports based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, delayed-egress locks and closers.
- E. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

F. Warranty: Special warranty specified in this Section.

G. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - b. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, and material of each door and frame.
 - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
 - 3) Complete designations of every item required for each door or opening including name and manufacturer.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) Door and frame sizes and materials.
 - 9) Description of each electrified door hardware function, if applicable, including location, sequence of operation, and interface with other building control systems.
 - a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
 - 10) List of related door devices specified in other Sections for each door and frame.
 - c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 2. Installer shall have warehousing facilities in Project's vicinity.
 3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Address for delivery of keys.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:
1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
 2. Review sequence of operation for each type of electrified door hardware.
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores, if applicable, to Owner by hand delivery, registered mail or overnight package service.

1.6 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that

adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

- B. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of operators and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
- 2. Warranty Period: 3 years from date of Substantial Completion, except as follows:
 - a. Bored Locksets: 7 years from date of Substantial Completion.
 - b. Mortise Locksets: 10 years from date of Substantial Completion.
 - c. Exit Devices: 5 years from date of Substantial Completion.
 - d. Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide 6 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required provide as specified.
 - 2. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
- C. In other Part 2 articles where titles below introduce lists of approved Manufacturers, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
 - 1. Two Hinges: For doors with heights up to 60 inches.
 - 2. Three Hinges: For doors with heights 61 to 90 inches.
 - 3. Four Hinges: For doors with heights 91 to 120 inches.
 - 4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:
 - 1. Entrance Doors: Heavy weight antifriction-bearing hinges.
 - 2. Doors with Closers: Standard weight antifriction-bearing hinges.
 - 3. Interior Doors: Standard weight hinges. Provide antifriction-bearing where specified in Part 3 "Door Hardware Sets" Article.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
 - 1. Exterior Hinges: Stainless steel, with stainless-steel pin or brass, with stainless-steel pin body and brass protruding heads as specified in Part 3 "Door Hardware Sets" Article.
 - 2. Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads , Steel, with steel pin or Stainless steel, with stainless-steel pin as specified in Part 3 "Door Hardware Sets" Article.
 - 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin, Stainless steel, with stainless-steel pin as specified in Part 3 "Door Hardware Sets" Article.
- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
 - 1. Non-removable Pins (NRP): Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
 - 2. Corners: Square.
- F. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames (Pilot holes required for wood doors and/or frames). For NRP hinges finish screw heads to match surface of hinges.

2.3 HINGES

- A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Approved Manufacturers:
 1. Stanley Hardware (STN).
 2. Hager Company.
 3. McKinney Hinge.

2.4 CONTINUOUS HINGES

- A. Standard: BHMA A156.26. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches fabricated to full height of door and frame as recommended by the Manufacturer.
 1. Fire Pins: Steel pins to hold labeled fire doors in place if required by tested listing.
- C. Continuous, Geared Hinges: Extruded-aluminum, geared hinge leaves joined by a continuous extruded-aluminum channel cap with concealed, self-lubricating thrust bearings.
 1. Approved Manufacturers:
 - a. Stanley Hardware (STN).
 - b. Hager Company.
 - c. McKinney Hinge.

2.5 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

- C. Lock Trim:
 - 1. Levers: Provide as specified in Part 3 "Door Hardware Sets" Article.
 - 2. Escutcheons (Roses): Provide as specified in Part 3 "Door Hardware Sets" Article.
 - 3. Dummy Trim: Match lock trim and escutcheons.
 - 4. Lockset Designs:
- D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors and as follows:
 - 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch bolt throw.
- E. Backset: 2-3/4 inches, unless otherwise indicated.
- F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Auxiliary Deadlocks: BHMA A156.5.
 - 3. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 4. Extended Lip Strikes: For locks used on frames requiring the additional length to protect frame and trim.
 - 5. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

2.6 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 - 1. Mortise Locks: BHMA A156.13.
- B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13. Listed under Category F in BHMA's "Certified Product Directory."
 - 1. Approved Manufacturers:
 - a. Best Access Systems (BST).
 - b. Corbin Russwin Hardware.
 - c. Schlage Lock Company

2.7 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Dutch-Door Bolts: Minimum 3/4-inch throw.
 - 2. Mortise Flush Bolts: Minimum 3/4-inch throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.

- C. Manual Flush Bolts: BHMA A156.16, Grade 1 unless Grade 2 is indicated designed for mortising into door edge.
 - 1. Approved Manufacturers:
 - a. Trimco (TRM).
 - b. Burns Manufacturing Co.
 - c. Don Jo Manufacturing.

2.8 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1 unless Grade 2 is indicated. Listed under Category G in BHMA's "Certified Product Directory."
- B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Outside Trim: Material and finish to match locksets, unless otherwise indicated.
 - 1. Match design for locksets and latchsets, unless otherwise indicated.
- F. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors and fire-rated wood doors as specified in Part 3 "Door Hardware Sets" Article.
- G. Approved Manufacturers:
 - 1. Precision Hardware, Inc. (PHI).
 - 2. Von Duprin.
 - 3. Sargent Manufacturing.

2.9 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
 - 1. Number of Pins: Six or Seven pin as required for this project.
 - 2. Mortise Type: Threaded cylinders with rings and cam as required for proper lock operation.
 - 3. Rim Type: Cylinders with back plate, flat type vertical or horizontal tailpiece and raised trim ring.

4. Bored-Lock Type: Cylinders with tailpieces as required for proper lock operation.
 - a. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick and drill resistant testing requirements in UL 437 (Suffix A).
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Construction Keying: Comply with the following:
 1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
 2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
 - a. Replace construction cores with permanent cores as directed by Owner or Architect.
- E. Manufacturer: Same manufacturer as for locks and latches.
- F. Approved Manufacturers:
 1. Best Access Systems (BST).

2.10 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
 1. No Master Key System: Cylinders are operated by change keys only.
 2. Master Key System: Cylinders are operated by a change key and a master key.
 3. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
 4. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
 5. Existing System: Master key or grand master key locks to Owner's existing system.
 6. Existing System: Re-key Owner's existing master key system into new keying system.
 7. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation.
 - a. Notation: As specified and determined at keying conference.
 2. Quantity: In addition to one extra key blank for each lock, provide the following:
 - a. Cylinder Change Keys: Three.
 - b. Master Keys: Five.
 - c. Grand Master Keys: Five.
 - d. Great-Grand Master Keys: Five.

2.11 OPERATING TRIM

- A. Standard: BHMA A156.6 and as illustrated on Drawings.
- B. Materials: Fabricate from aluminum, brass, bronze or stainless steel, unless otherwise indicated in Part 3 "Door Hardware Sets" Article.
- C. Approved Manufacturers:
 - 1. Trimco (TRM).
 - 2. Burns Manufacturing Co.
 - 3. Don Jo Manufacturing.

2.12 CLOSERS

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
 - 1. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
- C. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
- D. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.
- E. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.
- F. Power-Assist Closers: As specified in Division 08 Section "Automatic Door Operators" for access doors for people with disabilities or where listed in the door hardware sets.
- G. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- H. Surface Closers: BHMA A156.4, Grade 1 unless Grade 2 is indicated. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
 - 1. Approved Manufacturers:

- a. Stanley Door Closers (SDC).
- b. Sargent Manufacturing.
- c. Norton Door Closers.

2.13 PROTECTIVE TRIM UNITS

- A. Size: 2 inches less than door width on push side and 1 inch less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from material as specified in Part 3 "Door Hardware Sets" Article.
 - 1. Material: 0.050-inch thick.
 - 2. Approved Manufacturers:
 - a. Trimco (TRM).
 - b. Burns Manufacturing Co.
 - c. Don Jo Manufacturing.

2.14 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
 - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Mechanical Door Holders: BHMA A156.16, Grade 1.
- C. Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1.
- D. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.
- E. Electromagnetic Door Holders: BHMA A156.15. Listed under Category C in BHMA's "Certified Product Directory."
 - 1. Coordinate with fire detectors and interface with fire alarm system for labeled fire door assemblies.
- F. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch fabricated for drilled-in application to frame.
- G. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame.
- H. Approved Manufacturers:
 - 1. Trimco (TRM).
 - 2. Burns Manufacturing Co.
 - 3. Don Jo Manufacturing.

2.15 DOOR GASKETING

- A. Standard: BHMA A156.22. Listed under Category J in BHMA's "Certified Product Directory."
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
 - 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
 - 3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke-labeled gasketing on 20-minute-rated doors and on fire and/or smoke-labeled doors.
- E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill].
- F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- I. Approved Manufacturers:
 - 1. Zero International.
 - 2. National Guard Products (NGP).
 - 3. Reese Weatherstrip.

2.16 THRESHOLDS

- A. Standard: BHMA A156.21. Listed under Category J in BHMA's "Certified Product Directory."
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
 - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.
- D. Approved Manufacturers:
 - 1. Zero International.
 - 2. National Guard Products (NGP).
 - 3. Reese Weatherstrip.

2.17 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Steel Machine or Wood Screws: For the following fire-rated applications:
 - a. Mortise hinges to doors.
 - b. Strike plates to frames.
 - c. Closers to doors and frames.
 - 3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
 - a. Surface hinges to doors.
 - b. Closers to doors and frames.
 - c. Surface-mounted exit devices.
 - 4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.18 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
 - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated [**on Drawings**] [**as follows**] unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective

trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately 6 months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SETS

- A. Refer to hardware schedule on drawings

END OF SECTION 087100

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass for other sections referencing this Section.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA) 800 - Voluntary Specifications and Test Methods for Sealants.
- B. American National Standards Institute (ANSI) Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International (ASTM):
 - 1. C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
 - 2. C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.
 - 3. C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 4. C920 - Standard Specification for Elastomeric Joint Sealants.
 - 5. C1036 - Standard Specification for Flat Glass.
 - 6. C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT, Coated and Uncoated Glass.
 - 7. C1115 - Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
 - 8. C1172 - Standard Specification for Laminated Architectural Flat Glass.
 - 9. C1184 - Standard Specification for Structural Silicone Sealants.
 - 10. C1281 - Standard Specification for Preformed Tape Sealants for Glazing Applications.
 - 11. C1294 - Standard Test Method for Compatibility of Insulating Glass Edge Sealants with Liquid-Applied Glazing Materials.
 - 12. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - 13. E119 - Standard Test Method for Fire Tests of Building Construction and Materials.
 - 14. E152 - Standard Test Method for Fire Test of Door Assemblies.
 - 15. E163 - Standard Test Method for Fire Tests of Window Assemblies.
 - 16. E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 - 17. E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
 - 18. E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - 19. F1233 - Standard Specification for Security Glazing Materials and Systems.
- E. Consumer Product Safety Commission (CPSC) 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- F. Glass Association of North America (GANA):
 - 1. Engineering Standards Manual.
 - 2. Glazing Manual.
 - 3. Laminated Glass Design Guide.

- G. Insulating Glass Manufacturers Alliance (IGMA):
 - 1. SIGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units.
- H. National Fenestration Rating Council (NFRC):
 - 1. 100 - Procedure for Determining Fenestration Product Thermal Properties.
 - 2. 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.
 - 3. 300 - Procedures for Determining Solar Optical Properties of Simple Fenestration Products.

1.3 SYSTEM DESCRIPTION

- A. Glass Thicknesses:
 - 1. Indicated thicknesses are minimums; select actual glass thicknesses by analyzing loads and conditions.
 - 2. Size glass to withstand positive and negative wind pressure acting normal to plane in accordance with Building Code as measured in accordance with ASTM E330.
 - 3. Provide glass in thicknesses and strengths to meet or exceed following criteria:
 - a. Comply with ASTM E1300.
 - b. Probability of breakage for vertical glazing: 8 lites per 1000 for lites set within 15 degrees of vertical and under wind load for load duration of 3 seconds.
 - c. Thickness of tinted glass: Provide same thickness for each tint color for all applications.
- B. Thermal and Optical Performance Properties: Provide glass meeting specified performance properties, based on manufacturer's published test data for units of thickness indicated:
 - 1. U-factor: Per NFRC 100 expressed as Btu/square foot x hour x degree F.
 - 2. Solar heat gain coefficient: Per NFRC 200.
 - 3. Solar optical properties: Per NFRC 300.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Descriptive data and performance attributes for insulated glass.
 - 2. Samples:
 - a. 12 x 12 inch glass samples [except clear].
 - b. 1/4 x 1/4 x 3 inch long sealant and glazing compound samples showing available colors.
 - 3. Warranty: Sample warranty form.
- B. Quality Control Submittals:
 - 1. Test Report: Preconstruction adhesion and compatibility test report from glazing sealant manufacturer, based on submitted samples or acceptable data from previous testing of current formulations with similar products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years experience in work of this Section.
- B. Regulatory Requirements:
 - 1. Provide safety glass for locations subject to human impact as required by Building Code.
 - 2. Safety glass: Tested and labeled to CPSC 16 CFR 1201.
- C. Perform Work in accordance with GANA Laminated Glass Design Guide and IGMA TB-3001.
- D. Fire Rated Glass Assemblies: Conform to ASTM E119.

1.6 PROJECT CONDITIONS

- A. Perform glazing when ambient temperature is above 40 degrees F.
- B. Perform glazing on dry surfaces.

1.7 WARRANTIES

- A. Insulating Glass Units: Provide manufacturer's 10 year warranty against material obstruction of vision through unit due to:
 - 1. Intrusion of dust or moisture.
 - 2. Internal condensation.
 - 3. Film formation on internal glass surfaces caused by failure of hermetic seal except failure caused in whole or in part by breakage or fracturing of any portion of glass surface.
- B. Glass Coatings: Provide manufacturer's 10 year warranty against peeling, cracking, or deterioration of coating under normal conditions.
- C. Laminated Glass Units: Provide manufacturer's 10 year warranty against manufacturing defects resulting in edge separation, delamination, or material obstruction of vision through glass surface.
- D. Mirrors: Provide manufacturer's 10 year warranty against silver spoilage resulting from manufacturing defects.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Glass:
 - 1. Guardian Industries Corp. (www.guardian.com)
 - 2. Oldcastle BuildingEnvelope. (www.oldcastlebe.com)
 - 3. Pilkington Architectural. (www.pilkington.com)
 - 4. PPG Industries, Inc. (<http://www.ppg.com/>)
 - 5. Viracon, Inc. (www.viracon.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS - GLASS

- A. Clear Glass: ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.
- B. Clear Tempered Glass: ASTM C1048, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select, Kind FT fully tempered.
- C. Clear Heat Strengthened Glass: ASTM C1048, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select, Kind HS heat strengthened.
- D. Tinted Glass:
 - 1. Type: ASTM C1036, Type 1 transparent flat, Class 2 tinted heat absorbing and light reducing, Quality q3 glazing select.
 - 2. Color: Green
- E. Tinted Tempered Glass:
 - 1. Type: ASTM C1048, Type 1 transparent flat, Class 2 tinted heat absorbing and light reducing, Quality [q3 glazing select,] [____,] Kind FT fully tempered.
 - 2. Color: Green.
- F. Tinted Heat Strengthened Glass:

1. Type: ASTM C1048, Type 1 transparent flat, Class 2 tinted heat absorbing and light reducing, Quality Kind HS heat strengthened.
2. Color: Green.

G. Mirror Glass: ASTM C1036, Type I transparent flat, Class 1 clear, Quality q1 mirror select.

2.3 MATERIALS - FIRE-RATED GLASS

A. Fire Rated [Safety] Glass:

1. Type: Specially tempered glass, clear, of fire resistance ratings indicated.

2.4 ACCESSORIES

A. Setting Blocks: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone; 80 to 90 Shore A durometer hardness.

B. Spacers: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone; 50 to 60 Shore A durometer hardness.

C. Glazing Gaskets:

1. Dense compression gaskets: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone or thermoplastic polyolefin rubber, molded or extruded shape to fit glazing channel retaining slot; black color.
2. Soft compression gaskets: ASTM C509, Type II, black, molded or extruded, neoprene, EPDM, silicone or thermoplastic polyolefin rubber, of profile and hardness required to maintain watertight seal; black color.

D. Contact Sealant (shop glazed):

1. Type: ASTM C1184, multi component, high modulus, neutral chemical curing silicone glazing and curtain wall sealant.
2. Movement capability: 12 percent in extension and compression.
3. Compatible with glass unit edge seals; tested to ASTM C1294.
4. Color: To be selected from manufacturer's full color range.

E. Contact Sealant (field glazed):

1. Type: Single component, medium modulus, neutral moisture curing silicone sealant; ASTM C1184 and ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G and A.
2. Movement capability: 50 percent in extension and compression.
3. Compatible with glass unit edge seals; tested to ASTM C1294.
4. Color: To be selected from manufacturer's full color range.

F. Weatherseal Sealant:

1. Type: Single component, low modulus, neutral moisture curing silicone sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G and A.
2. Movement capability: 50 percent in extension and compression.
3. Compatible with glass unit edge seals; tested to ASTM C1294.
4. Color: To be selected from manufacturer's full color range.

G. Glazing Sealant: ASTM C920, Type S, Grade NS, Class 25; single component silicone, low modulus, non sag, color to be selected from manufacturer's full color range.

H. Sealant Backing: ASTM C1330, Type O, size and density to control glazing sealant depth and produce optimum glazing sealant performance.

I. Primer: As recommended by glazing sealant manufacturer.

J. Glazing Tape: ASTM C1281 and AAMA 800; butyl based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for installation.

- K. Mirror Adhesive: Adhesive setting compound, produced specifically for setting mirrors by spot application method.
- L. Mirror Frame: Roll formed stainless steel channel, No. 4 satin finish, 1/2 x 1/2 inch, 18 gage, mitered corners.
- M. Laminating Film: Polyvinyl butyral sheet, thickness as required for impact resistance (small and large missile), clear.

2.5 FABRICATION

- A. Annealed Glass: Comply with ASTM C1036.
- B. Heat Strengthened Tempered Glass:
 - 1. Comply with ASTM C1048.
 - 2. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.
- C. Sealed Insulating Glass:
 - 1. Comply with ASTM E2190.
 - 2. Fabricate spacer bar frame of tubular aluminum filled with desiccant.
 - 3. Bond spacer bar frame to glass panes with twin primary seals.
 - 4. Fill space outside frame to glass edge with elastomeric sealant.
- D. Laminated Glass:
 - 1. Comply with ASTM C1172 and ANSI Z97.1.
 - 2. Laminate glass with laminating film by manufacturer's standard heat and pressure process.
 - 3. Cut glass to required size at factory.
 - 4. Discard glass with voids, delamination, or entrapped dirt or foreign matter.
- E. Low-E Coated Glass: Apply low-emissivity coating to scheduled glass surface.
- F. Mirror Glass:
 - 1. Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing compound to back surface of glass.
 - 2. Isolate glass from frame with resilient, waterproof padding.
- G. Fabrication Tolerances: ASTM C1036 and ASTM C1048.
- H. Glass Identification:
 - 1. Apply manufacturer's label indicating type and thickness to each light of glass. Show position of exterior face when installed, where applicable.
 - 2. Etch manufacturer's label on each light of tempered glass.
- I. Source Quality Control:
 - 1. Preconstruction adhesion and compatibility testing:
 - a. Perform adhesion test including ultraviolet exposure through glass on production samples of metals and glass in accordance with ASTM C794.
 - b. Test glass units, glazing materials, and glass framing members with specified finish for sealant compatibility, priming, and preparation requirements for optimum adhesion and performance.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean glazing rabbets; remove loose and foreign matter.
- B. Remove protective coatings on metal surfaces.
- C. Clean glass just prior to installation.

3.2 INSTALLATION - GENERAL

- A. Install glass in accordance with glass manufacturer's instructions.
- B. Maintain manufacturer's recommended edge and face clearances between glass and frame members.

3.3 INSTALLATION - STRUCTURAL SILICONE GLAZING METHOD

- A. Mask aluminum and glass surfaces adjacent to sealant pockets.
- B. Install temporary glass retainers to align faces of glass.
- C. Apply contact sealant; completely fill pockets. Tool joints and remove masking tape before sealant skim cure begins.
- D. Allow sealant to cure minimum time required by manufacturer.
- E. Remove temporary glass retainers.
- F. Insert joint backing to fill void between glass unit edges and glass spacer.
- G. Mask both sides of glass for full length of joint.
- H. Apply weatherseal sealant; tool to smooth, slightly concave profile.

3.4 INSTALLATION - SILICONE GLAZING METHOD

- A. Mask both sides of joint for full length.
- B. Install temporary glass retainers to align faces of glass.
- C. Provide temporary joint backing for one side of joint.
- D. Apply sealant to completely fill spaces; tool to smooth, slightly concave surface.
- E. Allow sealant to cure minimum time required by manufacturer. Remove temporary backing and fill voids with additional sealant.

3.5 INSTALLATION - GASKET GLAZING METHOD

- A. Fabricate gaskets to fit openings; allow for stretching of gaskets during installation.
- B. Set soft compression gasket against fixed stop or frame with bonded miter cut joints at corners.
- C. Set glass centered in openings on setting blocks.
- D. Install removable stops and insert dense compression gaskets at corners, working toward centers of glass, compressing glass against soft compression gaskets to produce weathertight seal.
- E. Seal joints in gaskets.

- F. Allow gaskets to protrude past face of glazing stops.

3.6 INSTALLATION - PRESSURE GLAZING METHOD

- A. Set glass unit in opening as recommended by system manufacturer.
- B. Tighten fasteners simultaneously at rate recommended by manufacturer to avoid unequal point pressures on glass.
- C. Torque fasteners to achieve required pressure against glass. Do not over tighten.

3.7 INSTALLATION - SEALANT GLAZING METHOD

- A. Apply sealant to full depth of permanent stops.
- B. Press glass into sealant with slight lateral movement to ensure adhesion.
- C. Apply sealant to full depth of removable stops. Secure stops in position, forcing contact with sealant bead and completely filling joint.

3.8 INSTALLATION - SEALANT AND TAPE GLAZING METHOD

- A. Apply tape to permanent stops, projecting slightly above sight line.
- B. Press glass into contact with tape.
- C. Install removable stops with spacer shims between stop and glass.
- D. Fill gap between removable stop and glass with glazing sealant.
- E. Trim protruding tape edges.

3.9 INSTALLATION - MIRRORS

- A. Support mirrors on concealed hanger brackets. Anchor rigidly to wall construction.
- B. Place plumb and level without distortion.

3.10 PROTECTION

- A. After installation, mark glass with an 'X' using removable plastic tape.

3.11 SCHEDULE

- A. Type 1: Small and large missile impact resistant
 - 1. Description:
 - a. Outboard lite: 1/4 inch thick tinted glass, tempered where required, with low-e coating on No. 2 surface.
 - b. Inboard lite: 9/16 inch thick clear laminated glass, tempered where required.
 - 2. Total unit thickness: 1 5/16 inch.
 - 3. Performance characteristics: Equal to "Solarban 60"
 - 4. Locations: Aluminum-framed entrances and storefront, Aluminum Curtainwall.
- B. Type 2:
 - 1. Description: 1/4 inch thick clear tempered glass.
 - 2. Locations: Interior doors and glazed openings at locations subject to human impact, excluding fire-rated assemblies.
- C. Type 3:

1. Description: 1/4 inch thick clear glass.
 2. Locations: Interior glazed openings at locations not subject to human impact, excluding fire-rated assemblies.
- D. Type 4:
1. Description: 1/4 inch thick clear fire-rated safety glass.
 2. Locations: Interior fire-rated glazed openings at doors and other locations subject to human impact.
- E. Type 5:
1. Description: 1/8 inch thick clear mirror glass.
 2. Locations: Toilet room mirrors.
- F. Type 6:
1. Description: 9/16 inch thick clear laminated impact resistant.
 2. Locations: Interior doors and glazed openings at Gymnasium locations subject to human impact, excluding fire-rated assemblies.

END OF SECTION

SECTION 09 2200

METAL SUPPORT ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal stud interior partition framing.
 - 2. Metal interior wall furring.
 - 3. Suspended metal channel soffit and ceiling framing.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. A591/A591M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications.
 - 2. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 3. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 4. A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
 - 5. C635 - Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - 6. C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 7. C645 - Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
 - 8. C754 - Standard Practice for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wall board, Backing Board, or Water-Resistant Backing Board.
 - 9. E90 - Standard Test Method for Airborne Sound Transmission Loss of Building Partitions.
 - 10. E413 - Standard Test Method for Classification for Rating Sound Insulation.
- B. Gypsum Association (GA) GA-600 - Fire Resistance Design Manual.
- C. Steel Stud Manufacturer's Association (SSMA)(www.ssma.com - Member Directory).
- D. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Illustrate framing types, gages, and locations.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years experience in work of this Section.
- B. Fire Resistance Ratings:
 - 1. Construct assemblies to achieve fire resistance ratings indicated on Drawings, in accordance with applicable GA or UL design number.
 - 2. If requirements of assembly numbers referenced conflict with Contract Document requirements, conform to assembly requirements.

- C. Acoustic Ratings: Construct assemblies to achieve acoustic ratings indicated on Drawings, tested to ASTM E90 and classified in accordance with ASTM E413.
- D. Deflection Limits:
 - 1. Limit deflection of partitions to following limits, based on 5 PSF uniform design load.
 - a. Partitions to receive tile: L/240.
 - b. Other partitions: L/120.
 - c. If partition height exceeds stud manufacturer's limiting height for applicable loading and deflection, install bracing above ceiling, decrease stud spacing, or increase stud gage.
 - 2. Limit deflection of ceilings to L/360.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Allsteel and Gypsum Products, Inc. (www.allsteelproducts.com)
 - 2. Consolidated Fabricators Corp. (www.confabbpd.com)
 - 3. Craco Manufacturing., Inc. (www.cracometals.com)
 - 4. Custom Stud, Inc. (www.customstud.com)
 - 5. Design Shapes in Steel.
 - 6. Frametek Steel Products. (www.frameteksteel.com)
 - 7. Olmar Supply Inc. (www.olmarsupply.com)
 - 8. Quail Run Building Materials, Inc. (www.qrbm.com)
 - 9. SCAFCO Corporation. (www.scafco.com)
 - 10. Steel Construction Systems. (www.steelconsystems.com)
 - 11. United Metal Products, Inc. (www.unitedmetalproducts.info)

- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Steel: A653/A653M or ASTM A1003/1003M, Class G90 hot dip galvanized.

2.3 COMPONENTS

- A. Provide components in accordance with ASTM C645.
- B. Studs: Non-load bearing roll-formed steel, SSMA stud profile, C-shaped, punched for utility access.
- C. Top and Bottom Tracks:
 - 1. Same material and finish as studs, C-shaped.
 - 2. Standard track: SSMA stud track profile, 1-1/4 inch legs.
 - 3. Deep leg track: SSMA deep stud track profile, 2 inch legs.
 - 4. Deflection track: Deep leg track with slotted screw holes; permit plus or minus 1/2 inch movement of overhead structure without damage to partition.
- D. Suspended Ceiling Framing:
 - 1. ASTM C635; manufactured specifically for suspended gypsum board ceiling applications.
 - 2. Tees: Double web design; 1-1/2 inches high with 1-3/8 inch wide knurled faces, with interlocking ends and punched holes for cross tees and hanger wires.
 - 3. Material: Galvanized steel.
- E. Wall Furring Channels: Hat shaped, depth as indicated, minimum 25 gage base steel thickness.

2.4 ACCESSORIES

- A. Fasteners: 3/8 inch long pan head screws.

- B. Wire: ASTM A 641, galvanized steel.
 - 1. Hanger wire: 8 gage base steel thickness.
 - 2. Tie wire: 18 gage base steel thickness, soft annealed.
- C. Wall Furring Brackets: Galvanized steel, two piece adjustable type.
- D. Furring Channel Clips: Galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION OF PARTITION FRAMING

- A. Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Attach top and bottom tracks at ends and 24 inches on center maximum.
- C. Position studs vertically in tracks, spaced maximum 16 inches on center unless indicated otherwise.
- D. Install deflection track at head of partitions extending to structure. Cut studs 1/2 inch shorter than required length and fit into top track. Fasten studs to top track in manner permitting track movement.
- E. Locate studs maximum 2 inches from door frames and abutting construction.
- F. Use heavier gage studs or double studs on both sides of openings in partitions.
- G. Install horizontal track as header above openings in partitions. Install studs from header to top track.
- H. Brace furred partitions with adjustable bracket located at mid height.
- I. Provide wood or metal bracing in partitions to receive and support fixtures, trim, accessories and other applied items.
- J. Brace ceiling height partitions to structure at 48 inches on center maximum.

3.2 INSTALLATION OF CEILING FRAMING

- A. Install in accordance with ASTM C636 and manufacturer's instructions.
- B. Space hanger wires maximum 48 inches on center. Install additional hangers where required to support light fixtures and ceiling supported equipment.
- C. Do not suspend hangers directly from metal deck. Attach steel channel horizontally to adjacent framing members; place hanger at regular spacing.
- D. Hang suspension system independent of walls, columns, ducts, pipes, and conduit.
- E. Where ducts or other equipment prevent regular spacing of hangers:
 - 1. Reinforce nearest related hangers to span extra distance, or:
 - 2. Suspend steel channel horizontally beneath duct or equipment; place hanger at regular spacing.
- F. Install main tees at maximum 48 inches on center. Fully engage end locks.
- G. Install cross tees perpendicular to main tees to form 24 x 48 inch modules. Lock cross tees to main tees.

3.3 INSTALLATION OF WALL FURRING

- A. Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Space channels 24 inches on center maximum and within 3 inches of corners; secure at maximum 24 inches on center with fasteners staggered on alternating flanges.
- C. Nest channels minimum 8 inches at splices; secure with two fasteners in each flange.

END OF SECTION

SECTION 09 2900

GYPSUM BOARD

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Acoustical insulation.
 - 2. Gypsum board.
 - 3. Cementitious panels.
 - 4. Taping and bedding of gypsum board.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. A108.11 - Interior Installation of Cementitious Backer Units.
 - 2. A118.9 - Test Methods and Specifications for Cementitious Backer Units.
- B. ASTM International (ASTM):
 - 1. C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 2. C514 - Standard Specification for Nails for the Application of Gypsum Wallboard.
 - 3. C665 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Wood Frame and Light Construction Buildings.
 - 4. C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Board.
 - 5. C1047 - Standard Specifications for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - 6. C1178 - Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
 - 7. C1396 - Standard Specification for Gypsum Board.
 - 8. C1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
 - 9. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 10. E90 - Standard Test Method for Airborne Sound Transmission Loss of Building Partitions.
 - 11. E413 - Standard Test Method for Classification for Rating Sound Insulation.
- C. Gypsum Association (GA):
 - 1. GA-214 - Levels of Gypsum Board Finish.
 - 2. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
 - 3. GA-600 - Fire Resistance Design Manual.
- D. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Illustrate panel product types, thicknesses, and locations; acoustical insulation; and accessories.

1.4 QUALITY ASSURANCE

- A. Fire Resistance Ratings:
 - 1. Construct assemblies to achieve fire resistance ratings indicated on Drawings, in accordance with applicable GA or UL design number.

2. If requirements of assembly numbers referenced conflict with Contract Document requirements, conform to assembly requirements.

B. Acoustic Ratings: Construct assemblies to achieve acoustic ratings indicated on Drawings, tested to ASTM E90 and classified in accordance with ASTM E413.

1.5 PROJECT CONDITIONS

A. Do not install gypsum board until building is substantially weathertight.

B. Maintain temperature in spaces in which work is being performed above 50 degrees F during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Gypsum Panels:

1. CertainTeed Gypsum, Inc. (www.certainteed.com)
2. GP Gypsum Corporation. (www.gp.com)
3. National Gypsum Co. (www.nationalgypsum.com)
4. USG Corporation. (www.usg.com)

B. Acceptable Manufacturers - Cementitious Panels:

1. James Hardie Building Products, Inc. (www.jameshardie.com)

C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS - GYPSUM PANELS

A. Regular Gypsum Board: ASTM C1396; 48 inches wide x 5/8 inch thick, maximum practical length, tapered edge.

B. Fire Resistant Gypsum Board: ASTM C1396, Type X; 48 inches wide x 5/8 inch thick, maximum practical length, tapered edge; apply to fire rated assemblies.

C. Impact-Resistant Gypsum Board: ASTM C1396 and ASTM C1629, Classification Level 2;; 48 inches wide x 5/8 inch thick, maximum practical length, tapered edge; apply to walls where indicated.

D. Water Resistant Gypsum Board: ASTM C1396; 48 inches wide x 5/8 inch thick, maximum practical length, water resistant; apply to walls at janitor closets and toilet rooms above tile.

2.3 MATERIALS - CEMENTITIOUS PANELS

A. Cementitious Panels: ANSI A 118.9, high density, cementitious with glass fiber reinforcing, 1/2 inch thick x 48 inches wide, maximum practical length, ends and edges square cut; apply to all walls to receive wall tile..

2.4 ACCESSORIES

A. Fasteners: ASTM C1002, Type S screws, minimum 5/8 inch penetration into framing.

B. Acoustical Insulation:

1. ASTM C665, Type I, glass fiber composition, unfaced.
2. Free from urea-formaldehyde resins, phenol, acrylics, and artificial colors.

C. Adhesive:

1. Type recommended by gypsum panel manufacturer.

- D. Trim Accessories: ASTM C1047.
 - 1. Material: Extruded PVC, perforated flanges.]
 - 2. Corner reinforcement: GA-216, Type CB-100 x 100.
 - 3. Casing: GA-216, Type LC.
 - 4. Control joint.
- E. Acoustical Sealer: Specified in Section 07 9200.
- F. Joint Treatment Materials:
 - 1. Reinforcing tape and joint compound; ASTM C475.

PART 3 EXECUTION

3.1 INSTALLATION OF GYPSUM PANELS

- A. Install panels and accessories in accordance with ASTM C754, GA-216, and manufacturer's instructions.
- B. Accurately cut panels to fit around openings and projections. Do not tear face paper or break gypsum core.
- C. Apply panels [at non fire-rated assemblies] in most economical manner, with ends and edges occurring over supports.
- D. Apply panels at fire-rated assemblies as required by design assembly.
- E. Stagger joints on opposite sides of partitions.
- F. Do not locate joints to align with edges of openings unless a control joint is installed.
- G. Mechanically fasten [single layer] panels to framing. Place fasteners minimum 3/8 inch from edges of panels; drive heads slightly below surface. Stagger fasteners at abutting edges.
- H. Apply face layer of double layer applications with joints offset from those in base layer; secure with mechanical fasteners to framing or with adhesive to base layer.
- I. At deflection compensating head tracks, cut panels 1/2 inch short of structure at head; do not secure panels to top runner channel.
- J. Treat cut edges and holes in moisture resistant gypsum board with joint sealer.
- K. Where recessed items occur in fire rated partitions, box item on all sides with gypsum board as required to maintain continuity of fire rating.

3.2 INSTALLATION OF ACOUSTICAL PARTITIONS

- A. Extend acoustical partitions past intersecting non-acoustical partitions.
- B. Install acoustical insulation:
 - 1. Butt to framing members and adjacent construction.
 - 2. Carry around pipes, wiring, outlets, and other construction without voids.
 - 3. Press against one gypsum board surface to form slight air space on opposite side.
- C. Seal acoustical partitions at perimeter and around penetrations:
 - 1. Apply continuous bead of sealer between gypsum panel edges and adjacent construction.
 - 2. Seal space between gypsum panels at control joints, prior to installing metal control joint.
 - 3. Apply sealer to penetrations through partitions.

3.3 INSTALLATION OF ACOUSTICAL INSULATION ABOVE CEILINGS

- A. Install acoustical insulation in continuous layer. Butt tightly to adjacent insulation and to other construction.
- B. Carry over pipes, wiring, boxes, and other construction without voids.

3.4 INSTALLATION OF CEMENTITIOUS PANELS

- A. Install in accordance with ANSI A108.11 and manufacturer's instructions.
- B. Apply panels horizontally, with ends occurring over supports. Stagger end joints in adjacent rows.
- C. Cut panels to fit around openings and projections.
- D. Mechanically fasten panels to framing at maximum 12 inches on center.

3.5 INSTALLATION OF ACCESSORIES

- A. Install in accordance with manufacturer's instructions.
- B. Install corner reinforcement at outside corners. Use single lengths where length of corner does not exceed standard length.
- C. Install casings where indicated and where gypsum board abuts dissimilar materials or stops with edge exposed.
- D. Install control joints at ceilings:
 - 1. At maximum 50 feet on center.
 - 2. Where ceiling framing changes direction.
- E. Install control joints at walls and partitions:
 - 1. At changes in backup material.
 - 2. At maximum 30 feet on center.
 - 3. Above both jambs of openings in partitions.

3.6 JOINT TREATMENT

- A. Treat joints and fasteners in gypsum board in accordance with GA-214.
- B. Levels of Finish:
 - 1. Surfaces in plenums Level 1 finish.
 - 2. All other Surfaces to receive paints: Level 4 finish.

END OF SECTION

SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Suspended metal ceiling grid system.
 - 2. Acoustical panels.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 2. C635 - Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - 3. C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 4. E1264 - Standard Classification of Acoustical Ceiling Products.
- B. Ceiling and Interior Systems Construction Association (CISCA) - Ceiling Systems Handbook.
- C. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Samples:
 - a. 12 x 12 inch acoustical panel samples.
 - b. 6 inch long suspension system samples showing each profile.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years experience in work of this Section.
- B. Installed System: Conform to referenced UL Floor/Ceiling Design No.
- C. Fire Hazard Classification: Class A rated, tested to ASTM E1264.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements: Install in approximately same conditions of temperature and humidity as will prevail after installation.

1.6 MAINTENANCE

- A. Extra Materials: One unopened carton of each acoustical panel.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Acoustical Units:

1. Armstrong World Industries, Inc. (www.armstrong.com)
2. Chicago Metallic Corporation. (www.chicago-metallic.com)
3. USG Corporation. (www.usg.com)

B. Acceptable Manufacturers - Suspension System:

1. Armstrong World Industries, Inc. (www.armstrong.com)
2. Certainteed Corporation (www.certainteed.com)
3. USG Corporation. (www.usg.com)

C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Suspension Grid System:

1. ASTM C635, intermediate duty, die cut, interlocking ends.
2. Grid type: Exposed T.
3. Material: Galvanized steel.
4. Runners: 1-1/2 inches high, 15/16 inch exposed width, flush profile.
5. Perimeter molding: Angle shape.
6. Finish: Factory applied enamel paint, sprayed and baked, white color
7. Accessories: clips, splices.

B. Acoustical Panels:

1. Source: "Dune" by Armstrong or approved substitute.
2. Size: 24x24 inches x 5/8 inch thick.
3. Edge configuration: Angled Tegular
4. Performance requirements: Tested in accordance with ASTM E1264.
 - a. NRC: 0.50.
 - b. CAC: 35.
 - c. Light reflectance: LR-0.83.

2.3 ACCESSORIES

A. Support Channels:

1. Galvanized steel; size and type to suit application.

B. Hanger Wire:

1. ASTM A641, minimum 12 gage galvanized steel.

C. Hold Down Clips: Minimum 24 gage spring steel, manufacturer's standard profile.

D. Touch-Up Paint: Color to match acoustical panels and suspension grid.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install ceilings in accordance with ASTM C636 and CISCA Handbook.

B. Minimize panels less than one half size.

C. Install molding around perimeters and abutting surfaces. Miter molding at exterior corners; cut flanges and bend web to form interior corners.

D. Space hanger wires maximum 48 inches on center. Install additional hangers where required to support light fixtures and ceiling supported equipment.

E. Do not suspend hangers directly from metal deck. Attach steel channel horizontally to adjacent framing members; place hanger at regular spacing.

- F. Hang suspension system independent of walls, columns, ducts, pipes, and conduit.
- G. Where ducts or other equipment prevent regular spacing of hangers:
 - 1. Reinforce nearest related hangers to span extra distance, or:
 - 2. Suspend steel channel horizontally beneath duct or equipment; place hanger at regular spacing.
- H. Install main tees at maximum 48 inches on center.
- I. Install cross tees to form 24 x 24 inch modules. Lock cross tees to main tees.
- J. Support ends of tees on flange of perimeter molding.
- K. Place acoustical panels with edges resting flat on suspension grid.
- L. Cutting Acoustic Units:
 - 1. Cut to fit irregular grid and perimeter edge trim and around penetrations.
 - 2. Locate cuts to be concealed.
 - 3. Cut and field paint exposed edges of reveal edge units to match factory edge.
- M. Place hold down clips over cross tees at mid point of each module.
- N. Lighting Fixture Protection: Form trapezoidal, five sided box of acoustical panels cut to size over each light fixture; conform to UL requirements.
- O. Installation Tolerances: Ceilings level to 1/8 inch in 12 feet measured in any direction.

3.2 ADJUSTING

- A. Touch up minor scratches and abrasions to match factory finish.

END OF SECTION

SECTION 09 65 30

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient Stair Treads and Landing.
- B. Related Sections:
 - 1. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.
 - 2. Division 09 Section "Static-Control Resilient Flooring" for resilient floor coverings designed to control electrostatic discharge.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Green Globes Submittals:
 - 1. Product Data for adhesives, including printed statement of VOC content.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.
- E. Product Schedule: For resilient products. Use same designations indicated on Finish Legend.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Mockups: Provide resilient products with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C)
- C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

- A. Resilient Base:
 - 1. Manufacturers: Subject to compliance with requirements:
 - a. Basis on Design: Johnsonite, Traditional Base
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TP (rubber, thermoplastic).
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inches (102 mm).

- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Miter cut.
- G. Inside Corners: Back "V" cut.
- H. Colors and Patterns: #20 Charcoal

2.2 RESILIENT STAIR ACCESSORIES

- A. Resilient Stair Treads:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johnsonite.
- B. Resilient Stair Treads Standard: ASTM F 2169.
 - 1. Material Requirement: Type TP (rubber, thermoplastic).
 - 2. Surface Design:
 - a. Class 2, Pattern: Bamboo
 - 3. Manufacturing Method: Group 2, tread with contrasting color for the visually impaired.
- C. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
- D. Nosing Height: 2 inches (51 mm).
- E. Thickness: 1/4 inch (6 mm) and tapered to back edge.
- F. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
- G. Colors and Patterns: As indicated on Finish Legend.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Cove Base Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
 - 4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and join at miter cut.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible, and "V" cut back.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 30

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SECTION 09666

RESILIENT SHEET FLOORING (HOMOGENEOUS VINYL)

PART 1 GENERAL

1.01 THIS SECTION INCLUDES

- A. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

- A. Select an installer who is competent in the installation of Armstrong resilient sheet flooring using heat-welded seams.
- B. Provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
- C. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
 - a. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.
 - b. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

1.05 SUBMITTALS

- A. Submit the manufacturer's standard samples showing the required colors for flooring, welding rods, and applicable accessories.
- B. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

1.06 ENVIRONMENTAL CONDITIONS

- A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
- C. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of 100°F (38°C) [85°F (29°C)] for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.
- D. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

PART 2 PRODUCTS

2.01 RESILIENT SHEET FLOORING MATERIALS

- A. Provide Medintech Homogeneous Vinyl Sheet Flooring, nonlayered and nonbacked, manufactured by Armstrong World Industries, Inc., in color selected from the range currently available from Armstrong World Industries, Inc., 72 in. (1.83 m) wide, having a nominal total thickness of 0.080 in. (2.0 mm). The smooth, polyurethane-coated wear surface shall be composed of polyvinyl chloride resin, plasticizers, stabilizers, fillers, and pigments comprising a through-grain vinyl chip visual with pattern and color uniformly dispersed throughout the entire thickness. The design shall merge subtle color accents with a detailed, terrazzo-like image providing a monolithic appearance. Vinyl sheet flooring shall meet ASTM F 1913, "Standard Specification for Vinyl Sheet Floor Covering Without Backing."
- B. Provide patterned vinyl weld rod as produced by Armstrong World Industries, Inc., and intended for heat welding of seams. Color shall be compatible with field color of flooring or as selected by Architect to contrast with field color of flooring. Color selected from the range currently available from Armstrong World Industries, Inc.

2.02 WALL BASE MATERIALS

- A. For integral flash cove base: Provide integral flash cove wall base by extending sheet flooring 6 in. (15.24 cm) up the wall using adhesive, welding rod, and accessories recommended and approved by the flooring manufacturer.

2.03 ADHESIVES

- A. Provide Armstrong S-575 Vinyl-Back Flooring Adhesive for field areas and Armstrong S-580 Flash Cove Adhesive at flash coving as recommended by the flooring manufacturer.

2.04 ACCESSORIES

- A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Armstrong S-183 Fast-Setting Cement-Based Underlayment.
- B. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- C. Provide top edge trim caps of plastic zero reducer for integral flash cove as approved by the Architect.
- D. Provide a fillet support strip for integral cove base with a minimum radius of 1 in. (2.54 cm) of plastic.
- E. Provide transition/reducing strips tapered to meet abutting materials.
- F. Provide threshold of thickness and width as shown on the drawings.
- G. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.
- H. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine subfloors prior to installation to determine that surfaces are smooth and free from

cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

- B. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- C. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- D. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.02 PREPARATION

- A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong[S-183 Fast-Setting Cement-Based Underlayment as recommended by the flooring manufacturer.
- B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.
- C. Perform subfloor Calcium Chloride Tests (and Bond Tests) as described in publication F-5061, "Armstrong Guaranteed Installation System," to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring.
- D. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

3.03 INSTALLATION OF SHEET FLOORING

- A. Install flooring in strict accordance with the latest edition of "Armstrong Guaranteed Installation System", F-5061.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 100-pound (45.36 kilogram) roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.
- F. Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.
- G. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- H. Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld

with vinyl welding rod in seams. Use methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.

- I. Provide integral flash cove wall base where shown on the drawings, including cove fillet support strip and top edge cap trim. Construct flash cove base in accordance with the flooring manufacturer's instructions. Heat-weld seams as specified for those on the floor.

3.04 INSTALLATION OF ACCESSORIES

- A. Fill voids with plastic filler along the top edge of the integral cove cap on masonry surfaces or other similar irregular substrates.
- B. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.
- C. Apply overlap metal edge strips where shown on the drawings, after flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.05 CLEANING AND PROTECTION

- A. Perform initial maintenance according to the latest edition of "Armstrong Guaranteed Installation System," F-5061.
- B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings. (See Finishing The Job in "Armstrong Guaranteed Installation System," F-5061.)

SECTION 09 9100

PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Surface preparation and field application of paints.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. D4442 - Standard Test Method for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
 - 2. D6886 - Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography.
- B. Green Seal, Inc. (GS) 11 - Standard for Paints and Coatings.
- C. Master Painters Institute (MPI) - Architectural Painting Specification Manual.
- D. Society for Protective Coatings (SSPC) - Painting Manual.
- E. South Coast Air Quality Management District (SCAQMD) Rule 1113 - Architectural Coatings.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's data on materials proposed for use including:
 - a. Product designation and grade.
 - b. Product analysis and performance characteristics.
 - c. Standards compliance.
 - d. Material content.
 - e. Mixing and application procedures.
 - 2. Paint Schedule: Indicate types and locations of each surface, paint materials, and number of coats to be applied.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Materials, Preparation, and Workmanship: Conform to MPI Painting Manual.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Container Labels: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage rates, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- B. Paint Materials: Store at ambient temperature from 45 to 90 degrees F in ventilated area, or as required by manufacturer's instructions.

1.6 PROJECT CONDITIONS

- A. Do not apply materials when surface and ambient temperatures or relative humidity are outside ranges required by paint manufacturer.
- B. Maintain ambient and substrate temperatures above manufacturer's minimum requirements for 24 hours before, during, and after paint application.
- C. Do not apply materials when relative humidity is above 85 percent or when dew point is less than 5 degrees F different than ambient or surface temperature.
- D. Provide lighting level of 30 footcandles at substrate surface.

1.7 MAINTENANCE

- A. Extra Materials: 1 gallon of each color and sheen.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 1. Benjamin Moore and Co. (www.benjaminmoore.com)
 2. Devoe Paint Co. (www.devoepaint.com)
 3. Glidden. (www.gliddenprofessional.com)
 4. Kelly-Moore Paints. (www.kellymoore.com)
 5. PPG Architectural Finishes, Inc. (www.pittsburghpaints.com)
 6. Pratt and Lambert Paints. (www.prattandlambert.com)
 7. Sherwin Williams. (www.sherwin-williams.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Paints:
 1. As scheduled at end of Section, or approved substitute.
 2. Free from all forms of lead and mercury.
- B. Gloss Ratings:

Gloss Designation	Units at 60 Degrees	Units at 85 Degrees
Flat	0 to 5	Maximum 10
Eggshell	10 to 25	10 to 35
Satin	20 to 35	Minimum 35
Semigloss	35 to 70	
Gloss	70 to 85	
High Gloss	Minimum 85	

2.3 ACCESSORIES

- A. Accessory Materials: Paint thinners and other materials required to achieve specified finishes; commercial quality.

- B. Patching Materials: Latex filler.
- C. Fastener Head Cover Materials: Latex filler.

2.4 MIXES

- A. Deliver paints pre-mixed and pre-tinted.
- B. Uniformly mix to thoroughly disperse pigments.
- C. Do not thin in excess of manufacturer's recommendations.
- D. Re-mix paint during application; ensure complete dispersion of settled pigment and uniformity of color and gloss.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Test shop applied primer for compatibility with subsequent coatings.
- B. Measure moisture content of surfaces using electronic moisture meter. Do not apply coatings unless moisture content of surfaces are below following maximums:
 - 1. Gypsum board: 12 percent.
 - 2. Masonry and concrete: 12 percent.
 - 3. Wood: 15 percent, measured to ASTM D4442.

3.2 PREPARATION

- A. General:
 - 1. Protect adjacent and underlying surfaces.
 - 2. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
 - 3. Correct defects and clean surfaces capable of affecting work of this section.
 - 4. Seal marks that may bleed through surface finishes with shellac.
- B. Impervious Surfaces: Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow to dry.
- C. Gypsum Board:
 - 1. Fill minor defects with filler compound. Spot prime defects after repair.
- D. Concrete and Masonry:
 - 1. Remove dirt, loose mortar, scale, salt and alkali powder, and other foreign matter.
 - 2. Remove oil and grease with solution of trisodium phosphate; rinse and allow to dry.
 - 3. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- E. Galvanized Steel: SSPC Method SP1 - Solvent Cleaning.
- F. Aluminum: SSPC Method SP1 - Solvent Cleaning.
- G. Uncoated Ferrous Metals: SSPC Method SP2 - Hand Tool Cleaning or Method SP3 - Power Tool Cleaning.
- H. Shop Primed Ferrous Metals (interior only):
 - 1. SSPC Method SP2 - Hand Tool Cleaning or Method SP3 - Power Tool Cleaning.
 - 2. Feather edges to make patches inconspicuous.

3. Prime bare steel surfaces.

I. Interior Wood:

1. Wipe off dust and grit.
2. Seal knots, pitch streaks, and sappy sections with sealer.
3. Fill nail holes and cracks after primer has dried; sand between coats.

3.3 APPLICATION

- A. Apply paints in accordance with manufacturer's instructions, Premium Grade finish requirements.
- B. Apply primer or first coat closely following surface preparation to prevent recontamination.
- C. Do not apply finishes to surfaces that are not dry.
- D. Apply coatings to minimum dry film thickness recommended by manufacturer.
- E. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- F. Apply coatings to uniform appearance without laps, sags, curtains, holidays, and brush marks.
- G. Allow applied coats to dry before next coat is applied.
- H. When required on deep and bright colors apply an additional finish coat to ensure color consistency.
- I. Continue paint finishes behind wall-mounted accessories.
- J. Sand between coats on interior wood and metal surfaces.
- K. Match final coat to approved color samples.
- L. Where clear finishes are specified, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- M. Prime concealed surfaces of interior wood in contact with masonry or cementitious materials with one coat primer paint.
- N. Mechanical and Electrical Components:
 1. Paint factory primed equipment.
 2. Remove unfinished and primed louvers, grilles, covers, and access panels; paint separately.
 3. Paint exposed and insulated pipes, conduit, boxes, ducts, hangers, brackets, collars, and supports unless factory finished.
 4. Do not paint name tags or identifying markings.
 5. Paint exposed conduit and electrical equipment in finished areas.
 6. Paint duct work behind louvers, grills, and diffusers flat black to minimum of 18 inches or beyond sight line.
- O. Do not Paint:
 1. Surfaces indicated on Drawings or specified to be unpainted or unfinished.
 2. Surfaces with factory applied finish coat or integral finish.
 3. Architectural metals, including brass, bronze, stainless steel, and chrome plating.

3.4 ADJUSTING

- A. Touch up or refinish disfigured surfaces.

3.5 CLEANING

- A. Remove paint from adjacent surfaces.

END OF SECTION

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel.
 - 2. Galvanized metal.
 - 3. Concrete Masonry Units
 - 4. Face Brick

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.

1.3 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As indicated on the finish.

2.2 PRIMERS/SEALERS

A. Alkali-Resistant Primer: MPI #3.

1. VOC Content: E Range of E2.

2.3 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E2.

B. Waterborne Galvanized-Metal Primer: MPI #134.

1. VOC Content: E Range of E1.

2.4 EXTERIOR LATEX PAINTS

A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).

1. VOC Content: E Range of E2.

B. Exterior Latex (Semi-gloss): MPI #10 (Gloss Level 5)

1. VOC Content: E Range of E2.

2.5 EXTERIOR ALKYD PAINTS

A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).

1. VOC Content: E Range of E1.

B. Exterior Alkyd Enamel (Semi-gloss): MPI #94 (Gloss Level 5).

1. VOC Content: E Range of E2.
- 2.6 EXTERIOR EXPOSTED CONCRETE MASONRY UNIT PAINT (for exterior brick screen wall):
 1. Waterborne, high build, modified acrylic waterproof coating
Basis of Design: MasterProtect HB300sb by Master Builders Solutions
- 2.7 EXTERIOR BRICK WEATHER SEAL (for exterior brick screen wall):
 1. Clear, solvent-based silicone elastomer seal
Basis of Design: Sure Klean Weather Seal, Blok-Guard and Graffiti Control 9 by Prosoco.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
 2. Remove all traces of chalking on existing, previously painted surfaces.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates Unpainted:

1. Alkyd System: MPI EXT 5.1D.

- a. Prime Coat: Alkyd anticorrosive metal primer.
- b. Intermediate Coat: Exterior alkyd enamel matching topcoat.

- c. Topcoat: Exterior alkyd enamel (semi-gloss).
- B. Galvanized-Metal Substrates Unpainted:
 - 1. Latex over water – based primer system: MPI EXT 5.3H.
 - a. Prime Coat: Waterborne galvanized-metal primer.
 - b. Intermediate Coat: Exterior Latex matching topcoat.
 - c. Topcoat: Exterior Latex, flat or semi-gloss.

END OF SECTION 09 91 13

SECTION 10 26 50

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner guards.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Green Globe Submittals:
 - 1. Product Data for adhesives, including printed statement of VOC content.
- C. Shop Drawings: For each impact-resistant wall protection unit. Include sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long.
- E. Material certificates.
- F. Material test reports.
- G. Maintenance data.
- H. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
- C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- D. Preinstallation Conference: Conduct conference at Project site.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of plastic and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 CORNER GUARDS

- A. Surface-Mounted, stainless steel corner guards: Assembly consisting of 16 gauge type #304 alloy with #4 satin finish, shipped with protective strippable coating; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
 - a. Basis-of-Design: C/S Group, Inc., Type C0-8 full height corner guards, or approved equal.
- B. Surface mounted engineered PETG continuous retainer with snap-on cover. Color matched end caps for both partial and full height applications. 3" legs with ¼" radiused cover and recycled PETG retainer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
 - 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Provide anchoring devices to withstand imposed loads.

- B. Immediately after completion of installation, clean covers and accessories using a cleaning agent recommended in writing by manufacturer.
- C. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 50

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SECTION 10 2813

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Toilet and shower accessories.
 - 2. Framed mirrors.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. A123/A123M - Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
 - 2. A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 3. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 4. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 5. B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - 6. C1036 - Standard Specification for Flat Glass.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data:
 - a. Schedule accessories by room; show plans and elevations, and identify room name and number, type and quantity of accessories, and mounting heights.
 - b. Include manufacturer's brochures showing sizes, details of function, finishes, and attachment methods.
 - 2. Samples: One of each accessory, if requested.
 - 3. Warranty: Sample warranty form.

1.4 QUALITY ASSURANCE

- A. Conform to applicable accessibility code for locating accessories.

1.5 WARRANTIES

- A. Furnish manufacturer's 10 year warranty providing coverage against mirror silver spoilage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. AJW Architectural Products. (www.ajw.com)
 - 2. American Specialties, Inc. (www.americanspecialties.com)
 - 3. Bobrick Washroom Equipment, Inc. (www.bobrick.com)

4. Bradley Corp. (www.bradleycorp.com)

B. Substitutions: Under provisions of Division 01

2.2 MATERIALS

A. Stainless Steel:

1. Sheet: ASTM A666, Type 304, rollable temper.
2. Tubing: ASTM A269.

B. Galvanized Steel:

1. ASTM A1008/A1008M.

C. Mirror Glass: ASTM C1036, Type I, Class 1, Quality q1, 1/4 inch thick.

2.3 ACCESSORIES

A. Fasteners: Stainless steel where exposed, hot dip galvanized where concealed; type best suited to substrate conditions.

2.4 FABRICATION

A. Use stainless steel for exposed surfaces; galvanized steel may be used in concealed locations.

B. Form exposed surfaces from single sheet of stock, free from joints, and flat, without distortion.

C. Weld joints of fabricated components and grind smooth.

D. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. [Peen grip surfaces.]

E. Fabricate soap dispensers to operate with less than 5 pound force.

F. Provide hangers, adapters, anchor plates, and accessories required for installation.

G. Key locks alike; furnish six keys.

H. Mirrors:

1. Frame: One piece, roll formed stainless steel channel, 1/2 x 1/2 inch, with corners mitered and welded.
2. Mirror: Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing compound to back surface of glass.
3. Backing: Galvanized steel sheet.
4. Isolate glass from frame and backing with resilient, waterproof padding.

I. Shop assemble units and package complete with anchors and fittings.

2.5 FINISHES

A. Stainless Steel: No. 4 satin.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set plumb, level, square, and rigid.

C. Install wiring between power supply and [hand] [hair] dryers.

3.2 SCHEDULE

MARK	DESCRIPTION	MANUFACTURER	MODEL NO.
A	Towel Dispenser and Waste Receptacle	Refer to Drawings	
B	Toilet Tissue Dispenser	Refer to Drawings	
C	Soap Dispenser	Refer to Drawings	
D	Feminine Tampon/Napkin Vendor	Refer to Drawings	
E	Feminine Tampon/Napkin Disposal	Refer to Drawings	
F	Grab Bars	Refer to Drawings	
G	Robe Hook	Refer to Drawings	
H	Mop Holder	Refer to Drawings	

END OF SECTION

SECTION 10 4413

FIRE EXTINGUISHERS AND CABINETS

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portable fire extinguishers.
 - 2. Cabinets.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM) E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops.
- B. National Fire Protection Association (NFPA) 10 - Portable Fire Extinguishers.
- C. Underwriters Laboratories (UL):
 - 1. 299 - Dry Chemical Fire Extinguishers.
 - 2. 711 - Rating and Fire Testing of Fire Extinguishers.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate cabinet locations and mounting heights.
 - 2. Product Data: Include data on extinguishers and cabinets, cabinet dimensions, operational features, materials, finishes, and anchorage.
- B. Closeout Submittals:
 - 1. Maintenance Data: Include test, refill, or recharge schedules and re-certification requirements.

1.4 QUALITY ASSURANCE

- A. Provide fire extinguishers complying with UL 711 and NFPA 10.
- B. Cabinets in Fire Rated Partitions: Tested in accordance with ASTM E814 with fire resistance rating equivalent to adjacent construction.
- C. Conform to applicable accessibility code for locating extinguishers.

1.5 PROJECT CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Ansul Incorporated. (www.ansul.com)
 - 2. JL Industries. (www.jlindustries.com)
 - 3. Larsen's Mfg. Co. (www.larsensmfg.com)

4. Potter Roemer. (www.potterroemer.com)

B. Substitutions: Under provisions of Division 01.

2.2 COMPONENTS

A. Extinguishers:

1. Multi-purpose dry chemical type, UL 299, cast steel tank, Class 2A:10B:C, 10 pound nominal capacity.

B. Cabinets:

1. Formed stainless steel sheet, 18 gage minimum.

2. Configuration: Semi-recessed, sized to accommodate extinguishers.

3. Trim: Flat trim. Returned to wall surface.

4. Door:

a. Full glass style, equipped with pull handle and latch keyed lock with emergency release or pull to break glass feature. Key locks alike; furnish six keys.

b. Hinge doors for 180 degree opening with continuous piano hinge.

c. Glazing: Clear acrylic.

d. Graphics: Letter FIRE EXTINGUISHER vertically on door in red die-cut vinyl pressure sensitive letters.

2.3 ACCESSORIES

A. Mounting Hardware: Type best suited to application.

2.4 FINISHES

A. Cabinet: No. 4 satin.

B. Extinguishers: Baked enamel, red color.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install cabinets in accordance with manufacturer's instructions.

B. Set plumb, level, and rigid.

C. Place an extinguisher in each cabinet.

END OF SECTION

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents.
- B. Principal features of work included are: Fire Protection system.

1.2 RELATED WORK

- A. Electrical power and interlock and control wiring and conduit.
- B. Field painting of exposed pipe.

1.3 GENERAL

- A. The contract documents form a guide for a complete system. Provide all items necessary to provide a complete system but not specifically mentioned, such as hangers, transitions, offsets, and drains.
- B. Layouts indicated on drawings are diagrammatical only. Coordinate exact location of equipment, ductwork, and piping to eliminate conflict with other divisions. Designer reserves right to make reasonable changes in location of equipment, and piping prior to construction.
- C. Should Contractor find during progress of work that in his judgment existing conditions make desirable a modification, report such item promptly to Designer for instructions. Do not make deviations from contract documents without review of Designer.
- D. Supervise all work with a competent mechanic specifically qualified in fire protection work.
- E. The installing sprinkler contractor shall be licensed or permitted by the state and local authority having jurisdiction to perform fire protection installations. This shall be in compliance with all applicable state and local laws.

1.4 PERMITS

- A. Secure and pay for permits, licenses, and inspections for work under this Division, including water connections.

1.5 CODES

- A. Comply with all pertinent local, state, and national codes.

1.6 STANDARDS

- A. Comply with all pertinent standards. This list is provided as a convenience to the contractor and is not to be considered all inclusive.
 - 1. NFPA 13: Standard on automatic sprinkler systems.
 - 2. NFPA 24: Standard on fire service line.

1.7 SUBMITTALS

- A. Submit for review complete brochures and shop drawings for materials and equipment proposed.
 - 1. Brochures: Submit complete descriptions, illustrations and specification data for materials and equipment proposed. Clearly indicate proposed items when other items are shown on same sheet. Submit samples on request and/or set up for inspection. Samples will be returned to Contractor.
 - 2. Shop Drawings: Complete equipment, and piping systems.

1.8 PROJECT MAINTENANCE MANUALS

- 1.9 Prior to final acceptance of project, provide Owner with bound maintenance manuals.

1.10 PROJECT TECHNICAL INSTRUCTION

- A. Prior to final inspection of project, provide technical instruction to Owner as follows:
 - 1. Field Instruction: Provide explanation of how systems and equipment are to operate.
 - 2. Field Demonstration: Demonstrate operation and routine maintenance for systems and equipment.

1.11 CONSTRUCTION RECORD DOCUMENTS

- A. Provide construction record documents. Keep at the project one set of drawings and daily record changes at the time they are made. Give drawings to Owner at project completion.

1.12 EXISTING SERVICES

- A. Maintain existing services in operation during construction. Coordinate and schedule all service interruptions with Owner.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Provide materials and equipment of domestic manufacturer bearing the U.L. and F.M. label when such label is available.

PART 3 – EXECUTION

3.1 COORDINATION

- A. Coordinate location of fire protection piping with equipment, ductwork, and other piping to eliminate conflict with other divisions.
- B. 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 in performance of contract.
- B. Correct unnecessary damage caused due to installation of fire protection work.
- C. Perform repairs with materials that match existing in accordance with the appropriate sections of these specifications.

3.3 TRENCHING, EXCAVATION AND BACKFILLING

- A. Provide trenching, excavation and backfilling necessary for performance of fire protection work in accordance with the appropriate section of these specifications.

3.4 IDENTIFICATION

- A. Identify exposed or accessible piping with stenciling contents indicating pipe contents and direction of flow on piping not more than 20 feet apart, at valves, at access panels, and at least once above each space.
- B. Paint piping exposed in equipment rooms and stairwells. Paint to be Sherwin Williams Metalatex fire protection red.
- C. Identify all 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.

3.5 CLEANING

- A. Repair damaged factory finishes covering all bare places and scratches.

3.6 TESTING

- A. Test all installed equipment and systems and demonstrate proper operation. Correct and retest work found defective when tested.
- B. Thoroughly check piping system for leaks. Do not add any leak-stop compounds to the system. Make repairs to piping system with new materials. Peening, doping, or caulking of joints or holes is not acceptable.

END OF SECTION

SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish materials, accessories, equipment, tools, and transportation and performance of all services and labor required to completely execute the sprinkler and fire protection work for this project, as indicated on the drawings and as herein specified.

1.2 SCOPE OF WORK

- A. Shop drawings.
- B. Valves including check valves, system valves.
- C. Pipe, fittings, interior.
- D. Hangers, supports and sleeves.
- E. Sprinkler heads, extra sprinkler cabinet.
- F. Alarm check valves and accessories.
- G. Testing and flushing.
- H. Excavation and backfill.
- I. Fire Department connection.
- J. Hydraulically calculate sprinkler system, wet and/or dry as required by drawings. Maximum water velocity shall be 25 feet per second.
- K. Cutting of holes necessary for the installation of work specified under this Section. Coordinate cutting of material with other Divisions. Employ services of other trades for patching of concrete, masonry, and other material. Use same material for patching and finish neatly.
- L. Unless otherwise noted on the drawings or these specifications, the entire project shall be fully protected, excluding no spaces.
- M. In an area of renovation and existing systems that are converted and/or extended to include the use of quick-response sprinklers, all existing sprinklers in the associated compartmented space shall be changed to quick response type. A compartmented space is defined as the entire smoke compartment.

1.3 DESIGN REQUIREMENTS

- A. Install system(s) in accordance with the drawings, specifications, and requirements of NFPA 13, and NFPA 24.
- B. Furnish material and labor necessary to fully comply with the drawings and specifications and with the rules, regulations, and ordinances.
- C. Reduction of the system area of operation as allowed per NFPA 13 is not acceptable on this project.
- D. Small room rule as allowed per NFPA 13 is not acceptable on this project.

E. Extended coverage heads are not acceptable on this project.

1.4 QUALITY ASSURANCE

- A. Materials bearing UL and FM approval, where such approval is applicable or required by the agencies having jurisdiction over fire protection work.
- B. The installing sprinkler contractor shall be licensed or permitted by the state and local authority having jurisdiction to perform fire protection installations. This shall be in compliance with all applicable state and local laws.

1.5 SUBMITTALS AND SHOP DRAWINGS

- A. The Contract Documents contain fire protection design drawings which indicate minor coordination. It is the responsibility of the Contractor to prepare detailed and coordinated working drawings and calculations, accurately representing the design of record.
- B. The Sprinkler Contractor shop drawings and calculations shall be stamped and signed by a firm employee who has a minimum NICET III level certification and signed by a Responsible Managing Employee. Shop drawings and calculations shall be submitted by a licensed and registered fire protection contractor.
- C. Equipment submittal drawings and data are required on all items named by manufacturer, including the following:
 - 1. Sprinkler Heads - Type and Manufacturer.
 - 2. Valves - Type and Manufacturer, interior.
 - 3. Water Flow and Tamper Switches - Type and Manufacturer.
 - 4. Piping and fittings.
- D. The sprinkler system shall be hydraulically designed by industry standard computer software. The Contractor shall submit computer calculations and copy of original water flow test report with working plans. Include in calculations allowance for outside hose streams and domestic water as required.
- E. Contractor will supply as-built drawings to the Owner, the Owner's Insurer, the Architect, the Engineer and other entities as required by the Owner or the Authority Having Jurisdiction.

1.6 SPRINKLER SYSTEM COORDINATION

- A. The contractor will be responsible for ensuring that the reflected ceiling plan shown on the working drawings is the latest revision from the Architect before commencing work.
- B. The contractor shall be responsible for providing to the Architect notification for any drawing changes resulting from movement of sprinkler piping or heads during installation.
- C. Failure to coordinate sprinkler system and building systems (including, but not limited to: ductwork, mechanical piping, and lighting fixtures) prior to fabrication or installation of sprinkler systems shall be corrected, modified, or changed as necessary at the expense of the contractor.
- D. The contractor is to completely investigate, PRIOR TO BID, all requirements of local water utility and fire department. Devices such as ADT and/or local alarm systems, double check valve assemblies, detector checks, tamper switches shall

be provided complete, wired, connected, and installed in accordance with local authorities by this Contractor. In the event the authorities have no installation details, the Contractor shall submit for approval proposed installation.

1.7 APPLICABLE CODES

- A. NFPA 13
- B. NFPA 24

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Products listed indicate standard.

2.2 VALVES

- A. Acceptable Valve Manufacturers: Ames, Nibco, Anvil, Mueller, Kennedy, Wilkins.
- B. Interior Valves:
 - 1. Check valves:
 - a. Iron body, Kennedy Valve 1126 swing check valve, flanged body. Bronze body, Nibco KT-403-W threaded check valve with dielectric unions.
 - 2. Gate valves:
 - a. Iron body, O.S.&Y. gate valves, Kennedy Valve FW-8068A, flanged.
 - b. Bronze body, O.S.&Y. gate valve, Nibco T-104-0, threaded with dielectric unions.
 - 3. Butterfly valves shall not be accepted.

2.3 PIPE AND FITTINGS

- A. Interior Pipe and Fittings:
 - 1. Piping shall be Schedule 40 black steel pipe 2" and smaller conforming to ASTM A135 or ASTM A53 and Schedule 10 black steel pipe 2-1/2" and larger conforming to ASTM A135.
 - 2. Fittings:
 - a. Ductile iron threaded fittings, ANSI B16.3 Class 300.
 - b. Cast iron threaded fittings, ANSI B16.4 Class 125 and 300 (extra heavy).
 - c. Cast iron flanged fittings, ANSI B16.1 Class 125 and 300.
 - d. Mechanical joint, grooved couplings, as manufactured by Tyco, Anvil, or equivalent. Couplings shall be rigid type, equivalent to 772 Domestic Rigid Coupling or Style 577 Rigid Import Coupling. All groove couplings and fittings shall be furnished by a single manufacturer.
 - 3. Piping for Dry Pipe systems and for drainage systems shall be Schedule 40 galvanized steel pipe, ASTM A795 or A135 with galvanized threaded fittings, ANSI B16.4, galvanized coated, both interior and exterior of pipe and fittings.
- B. Hangers, Supports, and Sleeves:
 - 1. Support piping with UL and FM approved hangers. Acceptable manufacturers: Anvil, B-Line, Fee & Mason.

2. Adjustable Clevis: Anvil Fig. 260.
3. Adjustable Swivel: Anvil Fig. 69.
4. Beam Clamp: Anvil Fig. 92 and Anvil Fig. 218 with retaining strap.
5. Concrete Fasteners: Anvil steel shell and expander plug.
6. Concrete Insert: Anvil Fig. 152.
7. Riser Clamp: Anvil Fig. 261.
8. Powder-driven inserts shall not be accepted.
9. All pipes passing through rated floors or walls shall be sleeved and/or firestopped to an equivalent rating of the floor or wall assembly. Firestop materials shall meet ASTM E814 requirements.
10. All piping hangers shall be listed for use with sprinkler systems.
11. All hangers, bracing, etc., shall be designed to constrain the sprinkler discharge resulting from a system pressure of 175 psig at the base of the riser.

2.4 SPRINKLER HEADS, EXTRA SPRINKLER CABINET

- A. Provide the following sprinkler heads of proper types, ratings, and spacings for areas involved. Provide appropriate finishes compatible with space finishes being served. Acceptable manufacturers: Tyco, Viking, and Reliable.
 1. Quick Response Type:
 - a. Pendent and brass upright chrome: Tyco TY-FRB (F.M. approved). K-Factor = 5.6
 - b. Recessed, chrome: Tyco TY-FRB (F.M. approved). K-Factor = 5.6
 - c. Fully concealed: Tyco-RF II, white coverplate. K-Factor = 5.6
 - d. Horizontal sidewall: Tyco-FRB chrome.
 - e. Dry: Tyco Model DS-1 fully concealed, K-Factor = 5.6.
 - f. Institutional: Quick Response: Tyco "Raven" chrome K-Factor = 5.6.
 - B. Pendent heads in ceilings and horizontal sidewall heads shall have one-piece, non-adjustable escutcheons. Two-piece or slip type escutcheons shall not be accepted. This does not apply to recessed heads.
 - C. Provide sprinkler cabinet with spare sprinkler heads per NFPA 13.
 - D. Contractor shall coordinate dry barrel length as required for field conditions.

2.5 SWITCHES

- A. Water Flow Switch: Notifier Model No. WFD-60 24 VDC vane type flow switch with pneumatic retard adjustable from 0 to 70 seconds, complete with two sets of single pole, double throw micro feature. Coordinate final voltage with Division 26.
- B. Tamper Switches: Notifier Model No. PIBV2(A) for 4" and larger, Potter Model No. OSYSU-2 24 VDC for pipe size less than 4", tamper switch double pole, double throw micro feature for ½- inch to 12-inch valves. Coordinate final voltage with Division 26.

2.6 WATER FLOW ALARMS

- A. Electric Alarm: Electrically operated 24 VDC red enameled 10" round gong with pressure alarm switch. Coordinate final voltage with Division 26. Notifier MB-G10 or approved equal.

- B. Contractor Option: Contractor has option of providing water motor alarm in lieu of electric bell. Contractor shall provide all piping, retarding chamber, valves, etc. As required for a functioning system at no additional cost to Owner.

2.7 FIRE DEPARTMENT CONNECTION

- A. Acceptable Manufacturers: Croker-Standard, Potter Roemer, Elkhart.)
 - 1. Fire Department Connection (Siamese): Croker-Standard, Figure Number 6010-PB 4 inch by 2-1/2 inch two-way, flushed polished brass, with double clapper inlets siamese fire department connection. Hose threads shall be in accordance with local fire department requirements. Provide plugs with chains.
- B. Provide signage per NFPA 13, and requirements of local authority having jurisdiction for proper identification for fire department service.
- C. Furnish material and labor necessary to fully comply with the drawings and specifications and with the rules, regulations, and ordinances.
 - 1. Provide a 3/4" ball drip for all types of fire department connections. Route discharge, to outside of building.

2.8 WET ALARM CHECK VALVES AND ACCESSORIES

- A. Wet Alarm Check Valve and Accessories – Electric Bell
 - 1. Alarm check valve shall be equal to Tyco CV-1FR with resilient elastomer seal facing on the spring-loaded clapper.
 - 2. Provide trim package to control include as a minimum as follows:
 - a. Main drain valve.
 - b. Pressure gauges (system and supply).
 - 3. Provide waterflow switch connected to electric bell and fire alarm system.

2.9 INSPECTOR TEST AND DRAIN

- A. Where indicated on drawings (riser or remote location), Inspector test and equal to AGF3011ASG. Inspector test and drain shall have:
 - 1. Body Material: Bronze body, brass stem, steel handle, chrome-plated bronze ball, virgin Teflon valve seat. Sight Glass: Bronze housing with viewing window.
 - 2. Components: A tamper resistant test orifice and a tapped port for system access.
 - 3. Pressure Relief Valve and Drainage Piping: AGF Model 7000.
 - a. Pressure Rating: Factory rated at 175 psi.
 - b. Body Material: Bronze body and stainless steel spring.
 - c. Components: Nylobraid flexible tube, two 1/2" NPT by barbed 90 degree elbows, external identification plate and integral flushing handle to remove debris.
 - d. 1/2 inch MIPT inlet, 1/2 inch FIPT outlet.
 - e. Relief pressure shall be factory set to project specifications.
 - f. Relief valve shall operate to the OPEN position between 90% and 105% of the set pressure.
 - g. Relief valve shall reseal or CLOSE at a minimum of 80% of set pressure.
 - 4. Test Orifice Size: As required by NFPA 13, latest edition.
 - 5. Size: F.I.P.T., same as connected piping.

6. Inlet and Outlet: Threaded.

2.10 DRY PIPE SYSTEM

- A. Dry Pipe System Alarm Check Valve :
1. Provide check type valve with divided seat ring, rubber faced clapper to automatically activate water motor alarm or electric alarm. Alarm check valve shall be equal to TYCO DPV-1 with trim package.
 2. Accelerator
 3. Test and drain
 4. Air Maintenance device with low pressure alarm
 5. Alarm switch with supervisory capability
 6. Pressure gauges where required by NFPA 13
- B. Air Compressor
1. Coordinate with Division 26 for all wiring connection to approved air compressor. Air compressor shall be selected for 120/1/60.
 2. Contractor to select air compressor to:
 - a. Restore system pressure within 30 minutes or as required by NFPA 13.
 - b. Maintain system pressure as required by approved dry pipe valve or shall be 20 psi in calculated trip pressure of dry pipe valve.
- C. Calculations:
1. Provide calculations for water delivery time by approved software.
 2. Water delivery shall be:
 - a. Light Hazard – 60 seconds
 - b. Ordinary Group 1 Hazard – 50 seconds
 - c. Ordinary Group 2 Hazard – 50 seconds
 3. Provide quick opening device as required.
- D. Drainage:
1. System branch lines shall be pitched at least ½ inch per 10 feet.
 2. Mains shall be pitched at least ¼ inch per 10 feet.
 3. Auxiliary Drains:
 - a. Located in areas subject to freezing shall be readily accessible.
 - b. If capacity of trapped section is less than 5 gallon drain shall consist of valve not less than ½ inch and drain plug.
 - c. If capacity of trapped section more than 5 gallon drain shall consist of two 1 inch valves and one 2 inch by 12 inch condensate nipple and shall be accessibly located.
 4. Test connection shall be located on end of most distant sprinkler pipe in upper story and equipped with readily accessible shut off valve and plug not less than 1 inch, at least one of which shall be brass.
- E. Gridded systems are not acceptable.

2.11 FIRE EXTINGUISHERS

- A. Fire Extinguisher (Wall Hung, ABC): Croker-Standard, Figure Number 4010, ten pound, ABC wall hung fire extinguisher, with UL rating of 4A:80B:C. Provide wall mounting bracket.
- B. Fire Extinguisher (CO2 Type, Wall Hung): Croker-Standard, Figure Number 4410 ten pound carbon dioxide fire extinguisher with an UL rating of 10B:C. Provide wall mounting bracket.

PART 3 – EXECUTION

3.1 COORDINATION

- A. Coordinate installation with other Divisions to ensure there are no conflicts. Fire protection piping shall not take priority in routing over HVAC ductwork.

3.2 PIPE INSTALLATION

- A. Connect to water main as shown on drawings.
- B. Install underground piping to provide a minimum cover of 2.5 feet over the top of the pipe. Provide 3 feet of cover under roads and driveways.
- C. Install underground service utility tape approximately 18 inches above pipe.
- D. Attach hangers to structural steel work as specified above, except that structural work shall not be drilled and punched. Wherever necessary, furnish, install, and securely anchor to or between building members suitable angle iron or other steel members to support sprinkler work.
- E. Provide support for grooved piping in conformance with requirements of MSS-SP-69, "Pipe Hangers and Supports - Selection and Application". In addition to these requirements, leave no horizontal pipe unsupported between any two couplings nor shall any pipe be left unsupported whenever a change in direction of flow takes place. Provide supports meeting the requirements stated above, but ensure that the distance between supports does not exceed the following:

PIPE SIZE	MAXIMUM SPAN BETWEEN HANGERS
1 Inch	8 Feet
1-1/4 through 2 Inch	10 Feet
2-1/2 through 4 Inch	12 Feet
5 through 8 Inch	14 Feet
10 through 12 Inch	15 Feet

- F. Support vertical piping at every other floor or every other pipe length, whichever is most frequent. Set the base of the riser or base fitting on a pedestal or foundation.
- G. Piping Above Grade:
1. In areas with no ceilings, run piping as high as possible. Minimum head room shall be 10'-0".
 2. Contractor is responsible for installation of seismic bracing required by code. The Contractor is responsible for coordinating with the Structural Engineer regarding proper seismic bracing.
- H. Underground Pipe:
1. Underground pipe and fittings shall be listed in the Underwriters' Laboratories approved fire protection equipment list.
 2. All underground piping for fire mains shall be installed, clamped and anchors, flushed and hydrostatically pressure tested according to the requirements of the Authorities Having Jurisdiction and NFPA 13 and 24.
 3. Trench and excavation work of the depth required by the Authorities and/or Agencies Having Jurisdiction for the proper installation of underground piping and valve shall be furnished by the sprinkler contractor.
 4. Trench and excavation work shall include excavating, cutting of holes

through foundation walls and floors, preparing of trenches, backfilling as specified.

- I. Provide section valves where shown on drawings, complete with tamper switch, water flow alarm, and drain connections. Provide sight-glass where inspector's test discharge cannot be readily seen when operating valve.
- J. All control valves and indicating valves shall be chained into the open position and equipped with signaling devices per NFPA 13 – 8.15.1.1.2.1.
- K. All metallic sprinkler piping, including but not limited to, all risers, cross mains, drains, and branches are to be primed with at least one coat of rust inhibitive primer before installation. (Except where stainless steel or chrome plated piping is used.)
- L. All sprinkler piping shall be hydrostatically tested at 200 psi and shall maintain that pressure with no loss for 2 hours or as required by NFPA 13 for normal pressure in excess of 150 psi.
- M. Provide drain valves, pipes and test connections as required by NFPA 13. Pipe drain lines and test connections to outside building as shown on the drawings and details. Test lines must originate from the most hydraulically remote point of each sprinkler zone. All drain piping and fittings shall be galvanized coated, no exception.
- N. Cross mains and feed mains shall not pass through electrical rooms or similar spaces. Only the branch line serving such spaces shall be permitted within the boundaries of these rooms.
- O. Drain plugs shall be installed on trapped sections of piping between 5 and 50 gallons. Auxiliary drain valves, 1 inch or larger, shall be installed on trapped sections of pipe greater than 50 gallons, and piped to an accessible location.
- P. All dry pipe systems shall be tested in addition to hydrostatic test, an air pressure leakage test at 40 psi for 24 hours with a maximum pressure loss of 1-1/2 psi.

3.3 SPRINKLERS

- A. Install sprinkler heads and required piping in areas such as concealed spaces, lab hoods, and other special areas and spaces as required by NFPA 13, NFPA 101, applicable state and local codes.
- B. Install sprinkler heads centerline of corridors and locate in the center of the ceiling tiles. Install sprinkler heads in other designated spaces in the center of the ceiling tiles and symmetrically locate with other heads within the ceiling. (See Architectural reflected ceiling plans.) Do not install sprinkler heads in other locations any closer than six (6) inches to any ceiling grid or wall.
- C. Install sprinkler heads centerline of corridors and locate in the center of the ceiling tiles. Install sprinkler heads in other designated spaces in the center of the ceiling tiles and symmetrically locate with other heads within the ceiling. (See Architectural reflected ceiling plans.) Do not install sprinkler heads in other locations any closer than six (6) inches to any ceiling grid or wall.
- D. Pendant sprinklers below ceiling shall be in alignment and parallel to ceiling features, walls, etc.
- E. When the light fixtures extend below the ceiling, the sprinklers shall be spaced so that the sprinkler spray pattern is not obstructed. See electrical plans.
- F. Provide guards on sprinkler heads where within 7'-6" of finished floor or wherever

- sprinklers may be subject to mechanical injury.
- G. Furnish one sprinkler cabinet complete with 12 sprinklers of assorted temperature ratings of the type necessary and in use throughout the installation, including one special sprinkler wrench. Locate and mount adjacent to riser.

3.4 MATERIAL AND TEST CERTIFICATE

- A. Provide copy of Contractor's Material and Test Certificate for underground and above ground piping as required by NFPA 13 and NFPA 24 in Owners O&M Manual.

3.5 OWNER'S INFORMATION CERTIFICATE

- A. Before commencing work, the sprinkler contractor shall obtain from the Owner, or his Agent, an Owner's Information Certification containing the elements outlined in NFPA 13 – 4.3.
- B. The Contractor shall provide a copy of the Owner's Certificate to the Engineer.

3.6 GUARANTEE

- A. The fire protection installation, as specified under this section of the specifications, shall be guaranteed for one year against defective equipment, materials, and workmanship.
- B. Guarantee shall not be construed as requiring the sprinkler contractor to render service or maintenance required in the normal operation of the equipment or to make repairs that may be needed due to normal wear and tear or the Owner's negligence, abuse, or breakage.

3.7 INSPECTION SERVICE

- A. After completion of the fire protection installation and at the start of the guarantee year, the Contractor shall execute the National Automatic Sprinkler and Fire Control Association, Inc., Standard form of "Inspection Agreement," without charge to the Owner, calling for four inspections of the sprinkler system during the guarantee year. These inspections will, at a minimum, comply with the provisions and requirements of NFPA 25. During the guarantee year, the inspections shall be made as per the inspection agreement, plus the following maintenance to be performed during the course of the fourth inspection.
 1. Operation of all control valves.
 2. Lubrication of operating stems of all interior control valves.
 3. Operation of water motor gong and/or electric alarms.
 4. Cleaning of alarm valves.
 5. Cleaning of dry pipe valves.
 6. Lubrication of Fire Department Connection inlets.
- B. The Standard Form of the National Automatic Sprinkler and Fire Control Association, Inc., "Report of Inspection" shall be filled out in triplicate after each inspection and the copies sent to the Owner, Insurance Carriers, Fire Department, or other authorities that the Owner may designate.

END OF SECTION

SECTION 21 10 00A – WATER BASED FIRE SUPPRESSION CALCULATIONS



Larson Fire
1643 Spalding Circle
Pensacola FL 32514
850-495-9410

Job Name : PC Surgery Center Jenks Aug Rev
Drawing :
Location : 1800 Jenks - Panama City FL
Remote Area : 1
Contract :
Data File : PC Surgery Center Jenks Aug Rev Area 1.WXF

HYDRAULIC CALCULATIONS
for

JOB NAME Panama City Surgery Center
Location 1800 Jenks - Panama City FL
Drawing #
Contract #
Date 6-24-2023

DESIGN

Remote area # 1
Remote area location South Addition
Occupancy classification Light/Ordinary
Density 0.10/0.15 - Gpm/SqFt
Area of application 1500 - SqFt
Coverage/sprinkler 130/225 - SqFt
Type of sprinkler calculated Upright and Pendent
Sprinklers calculated 15
In-rack demand - GPM
Hose streams 250 - GPM
Total water required (including hose streams) 570.228 - GPM @ 47.2764 - Psi
Type of system Wet
Volume of system (dry or pre-action) - Gal

WATER SUPPLY INFORMATION

Test date 6-22-2023
Location Jenks and 19th
Source of info Flow test with PC Fire Dept.

CONTRACTOR INFO

Address
Phone #
Name of designer Jay Larson
Authority having jurisdiction

NOTES:

Calculations include Ordinary hazard rooms and density
in the light hazard calculations.
Ordinary hazard hose allowance included.

text1(35) - invisible

Water Supply Curve

Larson Fire
PC Surgery Center Jenks Aug Rev

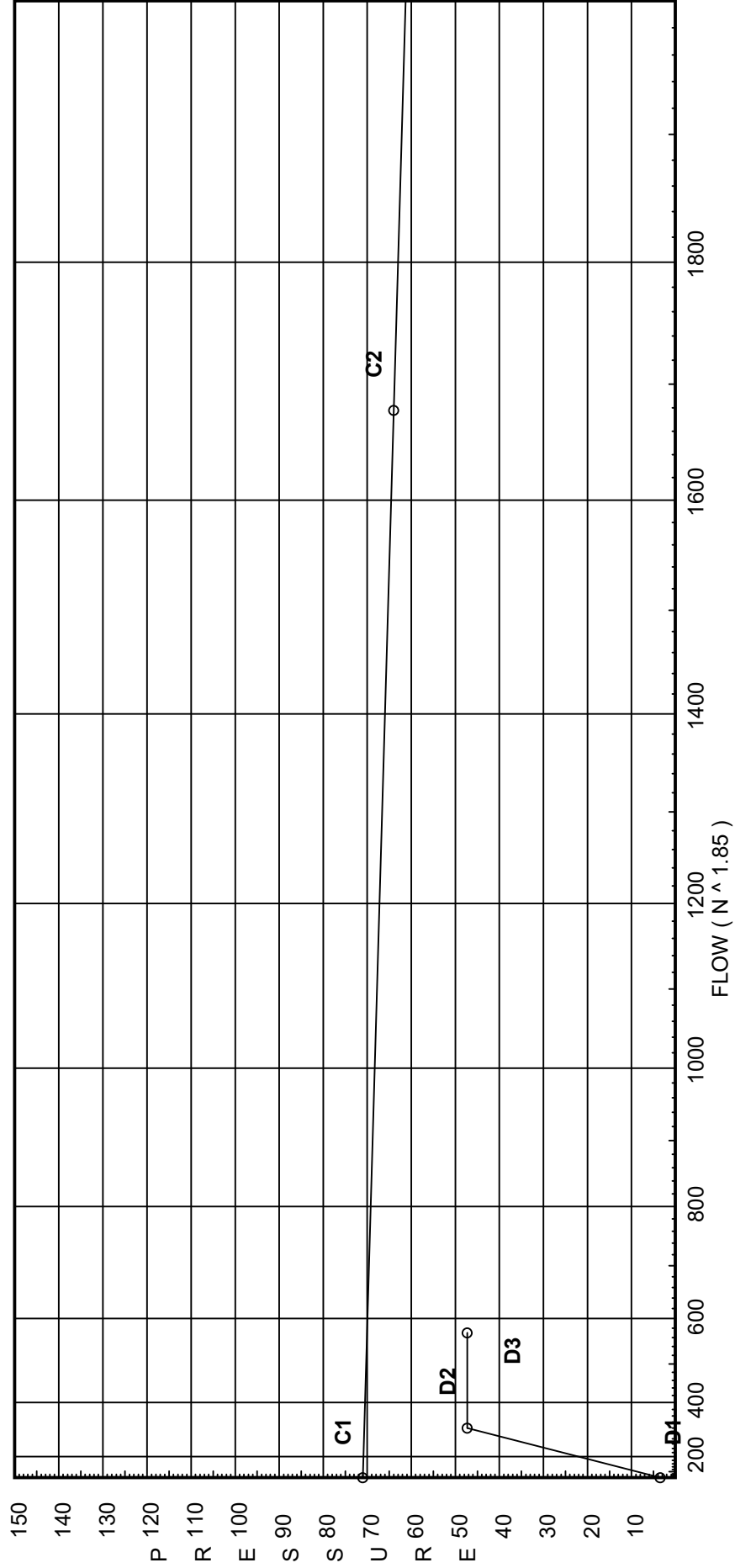
Page 2
Date

City Water Supply:

C1 - Static Pressure : 71
C2 - Residual Pressure: 64
C2 - Residual Flow : 1678

Demand:

D1 - Elevation : 3.465
D2 - System Flow : 320.228
D2 - System Pressure : 47.276
Hose (Demand) : 250
D3 - System Demand : 570.228
Safety Margin : 22.773



Fittings Used Summary

Larson Fire
PC Surgery Center Jenks Aug Rev

Page 3
Date

Fitting Legend Abbrev. Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E NFPA 13 90° Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
S NFPA 13 Swing Check	0	0	5	7	9	11	14	16	19	22	27	32	45	55	65					
T NFPA 13 90° Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
V Vic 90° Ell Firelock #001	0	0	0	0	0	3.5	4.3	5	0	6.8	8.5	10	13	4.5	5.1	0	0	0	0	0
X Vic 90° Tee-Branch #002	0	0	0	0	0	8.5	10.8	13	0	16	21	25	33	9.3	11	0	0	0	0	0
Zaf Ames 3000SS	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

- Diameter Units Inches
- Length Units Feet
- Flow Units US Gallons per Minute
- Pressure Units Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Flow Summary - NFPA

Larson Fire
PC Surgery Center Jenks Aug Rev

Page 4
Date

SUPPLY ANALYSIS

<i>Node at Source</i>	<i>Static Pressure</i>	<i>Residual Pressure</i>	<i>Flow</i>	<i>Available Pressure</i>	<i>Total Demand</i>	<i>Required Pressure</i>
TEST	71.0	64	1678.0	70.05	570.23	47.276

NODE ANALYSIS

<i>Node Tag</i>	<i>Elevation</i>	<i>Node Type</i>	<i>Pressure at Node</i>	<i>Discharge at Node</i>	<i>Notes</i>
DP02	10.0	5.6	7.17	15.0	0.1 150
EQ02	11.0		7.2		
DP01	10.0	5.6	7.17	15.0	0.1 150
EQ01	11.0		6.97		
SP04	12.0	5.6	7.17	15.0	0.1 150
EQ04	11.0		8.07		
SP03	12.0	5.6	7.17	15.0	0.1 150
EQ03	11.0		7.84		
SP05	12.0	5.6	10.33	18.0	0.15 120
EQ05	11.0		11.09		
SP06	12.0	5.6	10.33	18.0	0.15 120
EQ06	11.0		11.41		
1	11.0	5.28	11.65	18.03	K=K @ EQ04
2	11.0		12.84		
3	11.0		13.31		
4	11.0		14.52		
5	11.0		16.77		
6	11.0		21.55		
7	11.0		21.59		
CONN	10.0		23.15		
TOP	10.0		26.94		
BASE	-3.0		34.67		
8	-3.0		36.39		
TEST	3.0		47.28	250.0	
11	11.0	5.36	12.01	18.57	K=K @ EQ03
12	11.0	5.33	12.67	18.97	K=K @ EQ06
13	11.0	5.33	13.74	19.75	K=K @ EQ06
14	11.0	5.33	15.88	21.24	K=K @ EQ06
15	11.0		21.45		
16	11.0		21.44		
17	11.0		21.42		
18	11.0	5.41	11.09	18.0	K=K @ EQ05
19	11.0	5.33	11.52	18.09	K=K @ EQ06
20	11.0	5.59	14.01	20.92	K=K @ EQ02
21	11.0	5.59	15.46	21.98	K=K @ EQ02
22	11.0	5.68	19.95	25.37	K=K @ EQ01
23	11.0		21.09		
24	11.0	5.41	15.03	20.96	K=K @ EQ05
25	11.0	5.59	17.17	23.16	K=K @ EQ02
26	11.0	5.59	19.09	24.42	K=K @ EQ02
27	11.0	5.68	19.95	25.38	K=K @ EQ01
28	11.0		21.13		

Flow Summary - NFPA

Larson Fire
PC Surgery Center Jenks Aug Rev

Page 5
Date

NODE ANALYSIS (cont.)

<i>Node Tag</i>	<i>Elevation</i>	<i>Node Type</i>	<i>Pressure at Node</i>	<i>Discharge at Node</i>	<i>Notes</i>
29	11.0	5.68	19.96	25.38	K=K @ EQ01
30	11.0		21.27		

Final Calculations : Hazen-Williams

Larson Fire
PC Surgery Center Jenks Aug Rev

Page 6
Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
DP02 to EQ02	10 11	5.60	15.00 15.0	1 1.049	T	5.0	1.000 5.000 6.000	120 0.0763	7.175 -0.433 0.458		Vel = 5.57	
EQ02			0.0 15.00						7.200		K Factor = 5.59	
DP01 to EQ01	10 11	5.60	15.00 15.0	1 1.049	E	2.0	1.000 2.000 3.000	120 0.0763	7.175 -0.433 0.229		Vel = 5.57	
EQ01			0.0 15.00						6.971		K Factor = 5.68	
SP04 to EQ04	12 11	5.60	15.00 15.0	1 1.049	T	5.0	1.000 5.000 6.000	120 0.0763	7.175 0.433 0.458		Vel = 5.57	
EQ04			0.0 15.00						8.066		K Factor = 5.28	
SP03 to EQ03	12 11	5.60	15.00 15.0	1 1.049	E	2.0	1.000 2.000 3.000	120 0.0763	7.175 0.433 0.229		Vel = 5.57	
EQ03			0.0 15.00						7.837		K Factor = 5.36	
SP05 to EQ05	12 11	5.60	18.00 18.0	1 1.049	E	2.0	1.000 2.000 3.000	120 0.1070	10.332 0.433 0.321		Vel = 6.68	
EQ05			0.0 18.00						11.086		K Factor = 5.41	
SP06 to EQ06	12 11	5.60	18.00 18.0	1 1.049	T	5.0	1.000 5.000 6.000	120 0.1070	10.332 0.433 0.642		Vel = 6.68	
EQ06			0.0 18.00						11.407		K Factor = 5.33	
1 to 2	11 11	5.28	18.03 18.03	1 1.049	T	5.0	6.070 5.000 11.070	120 0.1073	11.650 0.0 1.188		K = K @ EQ04 Vel = 6.69	
2 to 3	11 11		18.57 36.6	1.5 1.61			9.530 9.530	120 0.0494	12.838 0.0 0.471		Vel = 5.77	
3 to 4	11 11		18.97 55.57	1.5 1.61			11.280 11.280	120 0.1070	13.309 0.0 1.207		Vel = 8.76	
4 to 5	11 11		19.75 75.32	1.5 1.61			12.000 12.000	120 0.1878	14.516 0.0 2.254		Vel = 11.87	
5 to 6	11 11		21.24 96.56	1.5 1.61	T	8.0	8.080 8.000 16.080	120 0.2973	16.770 0.0 4.781		Vel = 15.22	
6 to 7	11 11		198.29 294.85	4 4.26			2.100 2.100	120 0.0205	21.551 0.0 0.043		Vel = 6.64	

Final Calculations : Hazen-Williams

Larson Fire
PC Surgery Center Jenks Aug Rev

Page 7
Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
7 to CONN	11 10		25.38 320.23	4 4.26	2V	17.907	29.080 17.907 46.987	120 0.0239	21.594 0.433 1.123		Vel = 7.21	
CONN to TOP	10 10		0.0 320.23	4 4.26	X	21.067	137.630 21.067 158.697	120 0.0239	23.150 0.0 3.794		Vel = 7.21	
TOP to BASE	10 -3		0.0 320.23	4 4.26	6V X	53.722 21.067	13.000 74.789 87.789	120 0.0239	26.944 5.630 2.100		Vel = 7.21	
BASE to 8	-3 -3		0.0 320.23	4 4.1	S B	31.974 17.44	30.000 49.414 79.414	140 0.0217	34.674 0.0 1.720		Vel = 7.78	
8 to TEST	-3 3		0.0 320.23	4 4.1	6E T G Zaf	87.202 29.067 2.907 0.0	350.000 119.176 469.176	140 0.0217	36.394 0.721 10.161		** Fixed Loss = 3.319 Vel = 7.78	
TEST			250.00 570.23						47.276		Qa = 250.00 K Factor = 82.93	
11 to 2	11 11	5.36	18.57 18.57	1 1.049	T	5.0	2.260 5.000 7.260	120 0.1135	12.014 0.0 0.824		K = K @ EQ03 Vel = 6.89	
2			0.0 18.57						12.838		K Factor = 5.18	
12 to 3	11 11	5.33	18.97 18.97	1 1.049	T	5.0	0.410 5.000 5.410	120 0.1179	12.671 0.0 0.638		K = K @ EQ06 Vel = 7.04	
3			0.0 18.97						13.309		K Factor = 5.20	
13 to 4	11 11	5.33	19.75 19.75	1 1.049	T	5.0	1.130 5.000 6.130	120 0.1272	13.736 0.0 0.780		K = K @ EQ06 Vel = 7.33	
4			0.0 19.75						14.516		K Factor = 5.18	
14 to 5	11 11	5.33	21.24 21.24	1 1.049	T	5.0	1.130 5.000 6.130	120 0.1455	15.878 0.0 0.892		K = K @ EQ06 Vel = 7.88	
5			0.0 21.24						16.770		K Factor = 5.19	
6 to 15	11 11		-198.29 -198.29	4 4.26			10.580 10.580	120 -0.0098	21.551 0.0 -0.104		Vel = 4.46	
15 to 16	11 11		25.38 -172.91	4 4.26			0.580 0.580	120 -0.0086	21.447 0.0 -0.005		Vel = 3.89	
16 to 17	11 11		68.55 -104.36	4 4.26			8.900 8.900	120 -0.0029	21.442 0.0 -0.026		Vel = 2.35	

Final Calculations : Hazen-Williams

Larson Fire
PC Surgery Center Jenks Aug Rev

Page 8
Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
17			0.0 -104.36						21.416		K Factor = -22.55	
18 to 19	11 11	5.41	18.00	1			4.030	120	11.086 0.0		K = K @ EQ05	
19 to 20	11 11	5.33	18.09	1.25	3E	9.0	15.400 9.000	120	11.518 0.0		Vel = 6.68	
20 to 21	11 11	5.59	20.92	1.5			13.000	120	14.006 0.0		K = K @ EQ02	
21 to 17	11 11	5.59	21.98	1.5	2E T	8.0 8.0	13.020 16.000	120	15.464 0.0		K = K @ EQ02	
17			78.99	1.61			29.020	0.2051	5.952		Vel = 12.45	
17			0.0 78.99						21.416		K Factor = 17.07	
22 to 23	11 11	5.68	25.37	1	T	5.0	0.680 5.000	120	19.947 0.0		K = K @ EQ01	
23 to 17	11 11		25.37	1.049			5.680	0.2021	1.148		Vel = 9.42	
23 to 17	11 11		0.0	1.5	T	8.0	4.790 8.000	120	21.095 0.0			
17			25.37	1.61			12.790	0.0251	0.321		Vel = 4.00	
17			0.0 25.37						21.416		K Factor = 5.48	
24 to 25	11 11	5.41	20.96	1	E	2.0	13.010 2.000	120	15.035 0.0		K = K @ EQ05	
25 to 26	11 11	5.59	20.96	1.049			15.010	0.1420	2.131		Vel = 7.78	
25 to 26	11 11	5.59	23.16	1.25			13.000	120	17.166 0.0		K = K @ EQ02	
26 to 16	11 11	5.59	24.43	1.5	T	8.0	6.920 8.000	120	19.089 0.0		K = K @ EQ02	
16			68.55	1.61			14.920	0.1577	2.353		Vel = 10.80	
16			0.0 68.55						21.442		K Factor = 14.80	
27 to 28	11 11	5.68	25.38	1	T	5.0	0.800 5.000	120	19.953 0.0		K = K @ EQ01	
28 to 15	11 11		25.38	1.049			5.800	0.2022	1.173		Vel = 9.42	
28 to 15	11 11		0.0	1.5	T	8.0	4.790 8.000	120	21.126 0.0			
15			25.38	1.61			12.790	0.0251	0.321		Vel = 4.00	
15			0.0 25.38						21.447		K Factor = 5.48	
29 to 30	11 11	5.68	25.38	1	T	5.0	1.490 5.000	120	19.960 0.0		K = K @ EQ01	
30 to 7	11 11		25.38	1.049			6.490	0.2023	1.313		Vel = 9.42	
30 to 7	11 11		0.0	1.5	T	8.0	4.790 8.000	120	21.273 0.0			
7			25.38	1.61			12.790	0.0251	0.321		Vel = 4.00	

Final Calculations : Hazen-Williams

Larson Fire
PC Surgery Center Jenks Aug Rev

Page 9
Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
7			0.0 25.38						21.594		K Factor =	5.46

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 WORK INCLUDED

Provide all labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents.

- A. Principal features of work included are:
 - 1. Plumbing system.
 - 2. Medical gas system.

1.2 RELATED WORK

- A. Electrical power and interlock and control wiring and conduit.
- B. Laboratory equipment.
- C. Field painting of equipment, and piping.

1.3 GENERAL

- A. The contract documents form a guide for a complete system. Provide all items necessary to provide a complete system but not specifically mentioned, such as hangers, transitions, offsets, and drains.
- B. Layouts indicated on drawings are diagrammatical only. Coordinate exact location of equipment, ductwork, and piping to eliminate conflict with other divisions. Designer reserves right to make reasonable changes in location of equipment, ductwork, and piping prior to construction.
- C. Should Contractor find during progress of work that in his judgment existing conditions make desirable a modification, report such item promptly to Designer for instructions. Do not make deviations from contract documents without review of Designer.
- D. Supervise all work with a competent mechanic specifically qualified in mechanical discipline.

1.4 PERMITS

- A. Secure and pay for permits, licenses, and inspections for work under this Division, including water and sewage connections.

1.5 CODES

- A. Comply with all pertinent local, state, and national codes.

1.6 STANDARDS

- A. Comply with all pertinent standards. This list is provided as a convenience to Contractor and is not to be considered all inclusive.
 - 1. American Gas Association (AGA).
 - 2. CISPI Standard 301.
 - 3. ASTM A 74.

1.7 SUBMITTALS

- A. Submit for review complete brochures and shop drawings for materials and equipment proposed.

1. Brochures: Submit complete descriptions, illustrations and specification data for materials and equipment proposed. Clearly indicate proposed items when other items are shown on same sheet. Submit samples on request and/or set up for inspection. Samples will be returned to Contractor.
2. Submittals shall be submitted in line by line format. Each submittal shall be provided with a cover letter and supporting documentation indicating how the submittal meets each line of the referenced specification section. All discrepancies between the construction documents and the submitted product shall be clearly identified for engineer evaluation.
3. If a product other than the basis of design is rejected by the engineer for any reason, the Contractor shall provide the basis of design product at no additional cost to the Owner.
4. Shop Drawings:
 - a. Complete equipment and piping systems in equipment rooms.
 - b. Complete equipment and piping systems in entire building.
 - c. Owner furnished equipment rough-in layouts.
 - d. Laboratory equipment rough-in layouts.
 - e. Firestop systems.

1.8 PROJECT MAINTENANCE MANUALS

- A. Prior to final acceptance of project, provide Owner with bound maintenance manuals.

1.10 PROJECT TECHNICAL INSTRUCTION

- A. Prior to final inspection of project, provide technical instruction to Owner as follows:
 1. Field Instruction: Provide explanation of how systems and equipment are to operate during each season and during emergencies.
 2. Field Demonstration: Demonstrate operation and routine maintenance for systems and equipment.
 3. Videotape: Provide videotape or DVD of field instruction and demonstration to Owner at completion.

1.11 CONSTRUCTION RECORD DOCUMENTS

- A. Provide construction record documents. Keep at the project one set of drawings and daily record changes at the time they are made. Give drawings to Owner at project completion.

1.12 EXISTING SERVICES

- A. Maintain existing services in operation during construction. Coordinate and schedule all service interruptions with Owner.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Provide materials and equipment of domestic manufacturer bearing the U.L. label when such label is available.
- B. Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF® International.

PART 3 – EXECUTION

3.1 COORDINATION

- A. Coordinate locations of equipment, and piping to eliminate conflict with other divisions.
- B. Carefully examine contract documents to be thoroughly familiar with items which require plumbing or mechanical connections and coordination. 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 in performance of contract.
- 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 FLASHING, COUNTERFLASHING, AND SEALING

- A. Flash, counterflash, and seal piping at penetrations of roofs and outside walls.

3.4 TRENCHING, EXCAVATION AND BACKFILLING

- A. 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 CONNECTION TO EQUIPMENT

- A. Rough-in and connect to lab 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. Do not rough-in until shop drawings showing rough-in locations have been reviewed by Designer.

3.6 IDENTIFICATION

- A. Identify exposed or accessible piping with stenciling contents indicating pipe contents and direction of flow on piping not more than 20 feet apart, at valves, at access panels, and at least once above each space.
- B. Contractors option to identify exposed or accessible piping with snap-on or strap-on type markers. Color code markers in accordance with ANSI. Indicate pipe contents and direction of flow on marker. Install markers on piping not more than 20 feet apart, at valves, at access panels, and at least once above each space.
- C. Include design operating pressures in psig for compressed air services.
- D. Sanitary waste, storm and buried lines need not be marked.
- E. Identify all 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.

- F. 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.

3.7 CLEANING

- A. Repair damaged factory finishes covering all bare places and scratches.
- B. Cleaning Domestic Water System: Flush domestic water system progressively by opening building outlets and permitting flow to continue from each until water runs clear. Sterilize system in accordance with requirements of State Department of Public Health by the following method or other method acceptable to local authorities:
 1. Introduce chlorine or a solution of calcium or sodium hypochlorite, filling lines slowly and applying sterilizing agent at a rate of 50 ppm of chlorine as determined by residual chlorine tests at ends of lines. Open and close all valves while the system is being chlorinated.
 2. After sterilizing agent has been applied and left standing for 24 hours, test for residual chlorine at ends of lines. If less than 25 ppm is indicated, repeat sterilizing process.
 3. After standing for 24 hours and tests show at least 25 ppm of residual chlorine, flush out system until all traces of chemical used are removed.

3.8 TESTING

- A. Test all installed equipment and systems and demonstrate proper operation. Correct and retest work found defective when tested.
- B. Thoroughly check piping system for leaks. Do not add any leak-stop compounds to the system. Make repairs to piping system with new materials. Peening, doping, or caulking of joints or holes is not acceptable.
- C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at a water pressure of 125 psig for two hours without leaks.
- D. Test drainage and venting system with necessary openings plugged to permit system to be filled with water and subjected to a minimum water pressure of 10 feet head at top of system. System to hold water for two hours without a water level drop greater than 4" in a 4" standpipe and without visible leakage. Test system in sections if minimum head can be maintained in each section.
- E. Conduct air or smoke test if in opinion of Designer reasonable cause exists to suspect leakage or low quality workmanship.
- F. Test gas piping and compressed air piping with Nitrogen at 100 psi for two hours without leaks.
- G. Test flush valves for proper operation.

END OF SECTION 22 05 00

SECTION 22 07 19 - PLUMBING INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Contractor shall provide all necessary labor, materials, tools, and equipment to perform work required on the drawings and specified herein.
- B. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials to be as specified in applicable sections of the specifications.
- C. All pipe fittings, valves, and strainers in insulated pipe systems to be insulated.
- D. Thermal resistance "R" values used herein are expressed in units of "Hour, Degrees F., Sq. Ft./BTU per Inch of Thickness" on a flat surface at a mean temperature of 75 degrees F.
- E. Note that where electric heat trace is called for, insulation is to be applied over heat trace.

- 1.2 "Contractor's Option" referred to in Materials below indicates optional materials which may be used as equals.

1.3 DEFINITIONS

- A. "Exposed" equipment, and piping are areas which will be visible without removing ceilings or opening access panels.
- B. Outdoors is considered exposed to the weather.
- C. Underground is buried, whereas in a trench below grade is considered concealed.

1.4 CERTIFICATION/QUALITY ASSURANCE

- A. Products shall meet applicable national, state, and local building codes and be U.L. (or other recognized testing lab) listed for intended service.
- B. All insulations, jackets, adhesives, coatings, sealers, and tapes shall have a flame spread rating of 25 or less and smoke development rating of 50 or less when tested in accordance with ASTM E-84, NFPA 225, U.L. 723, and further must meet the requirements of NFPA 90-A and applicable building, and plumbing, codes.
- C. All insulation materials shall be delivered and stored in manufacturers' containers and kept free from dirt, water, chemical, and mechanical damage.
- D. Insulation shall be applied in a workmanlike manner by experienced, qualified tradesmen.
- E. Insulation shall not be applied until all pressure testing has been completed, inspected, and released for insulation application.
- F. Surfaces shall be clean and dry.
- G. Insulation joints shall be butted firmly together and all jackets and tapes shall be smoothly and securely installed.

- H. Insulation for duct, pipe, and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 1" thickness in less than 53 seconds when tested in accordance with ASTM D-1692.

1.5 APPLICABLE CODES AND STANDARDS

- A. ASTM E-84
- B. U.L. 723.
- C. State of Florida Energy Code.
- D. National Fire Protection Association

PART 2 – PRODUCTS

2.1 MATERIALS FOR PIPE AND EQUIPMENT

- A. Materials for Pipe and Equipment: Provide factory pre-molded or shop or site mitered segment type insulation for pipe, pipe fittings, and valves. Fitting insulation to be of same thickness and material as adjoining pipe insulation. All insulation and related materials such as tape and mastic to meet applicable building code requirements for fire and smoke development.
 - 1. Flexible Tubular: Provide 25/50 rated, closed-cell, flexible tubular rubber type pipe insulation. Product to have continuous operational temperature limit of 200 degrees and a minimum "R" value of 3.7 per inch ($K=0.27$) at 75 degrees F mean temperature. Product to be Armstrong AP Armaflex or approved equal pipe insulation. Use flexible tubular for the following services:
 - a. Horizontal runs of waste lines carrying cold condensate from air conditioning equipment: 1" thick.
 - 2. Fiberglass: Provide factory-formed, factory-jacketed fiberglass piping insulation. Product to be Manville "Micro-Lok 650" with "Type AP-T" jacketing or equivalent product manufactured by CertainTeed, Knauf, or Owens-Corning. Product to have continuous operational temperature limit of 850 degrees F and a minimum "R" value of 4.3 per inch ($K=0.23$) at 75 degrees F mean temperature. Jacket to be fiberglass reinforced kraft paper with aluminum foil and pressure sensitive closure system. Vapor-barrier mastic for application to below ambient pipe insulation shall be fungus resistant per ASTM D 5590 with 0 growth rating; Water based; Permeance per ASTM E 96, Procedure B, 0.013 perm or less at 43-mil dry film thickness suitable for indoor and jacketed outdoor use. Products: Foster 30-80 AF. Color: White. A breather mastic for application to above ambient pipe insulation (fittings, tees, valves, etc.) shall be water based Foster 46-50 mastic or Childers CP-10 / CP-11. Use fiberglass piping insulation for the following services:
 - a. Domestic hot water supply without recirculating system: 1-1/4" and under - 1/2" thick; 1-1/2" and greater - 1" thick.
 - b. Domestic hot water supply and recirculating return piping: All sizes – 1" thick.
 - c. Domestic cold water piping: 1/2" thick.
 - d. Horizontal rainwater leaders, overflow leaders, and roof drain bodies: 1" thick.

2.2 MATERIALS FOR FITTINGS, VALVES, AND SPECIAL COVERINGS

- A. Provide coverings and finishes for specific items hereinafter specified.
 - 1. Use pre-molded insulation fabricated by the manufacturer of insulation material or shop or site mitered segment type insulation for all pipe fittings, elbows, tees, valves, and couplings.
 - 2. PVC fitting covers over blanket fiberglass are NOT acceptable.
- B. For any service, when below grade direct buried, cover straight pipe and fitting insulation with equivalent of Pittsburgh Corning "Pittwrap", Foster C.I. Wrap 50 mil or "Pittwrap SS11" jacketing. Valves in systems operating above 60 degrees F. and installed in valve boxes shall not be insulated; however, the valves shall be painted with a rust resistant product equivalent to Rustoleum.
- C. For flexible tubular pipe and fitting insulation when exposed-to-view inside building or exposed to the weather, finish with two coats of paint, custom color blended to match surrounding surfaces.
- D. When specifically approved by designer, when it is impossible to completely insulate pipe, fittings, or valves with specified insulation, Armstrong Armaflex insulation tape may be used to prevent condensate drip on small piping. Use of cork insulation tape is prohibited.

PART 3 – EXECUTION

3.1 GENERAL

- A. No insulation shall be cut where a hanger is located. If hangers have been installed by pipe fitter tradesmen which violates this strict requirement, notify Designer immediately.
- B. Piping systems shall be tested and found free of all leaks prior to installation of insulation covering.
- C. All surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and during application of any finish, unless such finish specifically requires a wetted surface for application.
- D. All adhesives, cements, and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.
- E. Install insulation using professional insulators who have adequate experience and ability.
- F. Exposed-to-view insulation shall have a well-tailored appearance.
- G. Treat insulated pipe in equipment rooms and where exposed to normal view, so surfaces may be painted with water base latex paint. Use of mastics, adhesives, or jacketing which cause "bleeding" is prohibited.

3.2 INSTALLATION OF PIPE AND EQUIPMENT COVERING

- A. Where fiberglass or flexible tubular insulation is used on piping sized 2" and larger, insert a section of foam glass insulation at hanger or support points between pipe and metal shield for full length of shield to prevent crushing of insulation. Insulation thickness to be same as adjoining insulation. Where insulation passes through pipe hangers and across trapeze supports, 12" long metal saddles shall be used. On cold pipe, vapor barrier should be carried through the hanger and sealed.
- B. Apply flexible tubular insulation to pipe and fittings using the slip-on method with all joints tightly fitted and sealed with Armstrong 520 adhesive or approved equal. Seal butt joints, miter joints and torn or damaged insulation with adhesive.

END OF SECTION 22 07 19

SECTION 22 11 16 DOMESTIC WATER PIPING VALVES

PART 1 - GENERAL

1.01 SYSTEM REQUIREMENTS

- 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 run approximately as shown on drawings or as structural and architectural conditions permit.
- C. All products used for dispensing potable drinking water must be lead free and meet the requirements of NSF 61 and NSF 372 test standards via third party testing and certification.

PART 2 PRODUCTS

2.01 COPPER PIPES

- A. Type "L" hard-drawn seamless copper tubing, ASTM B-88: Domestic hot and cold water.
- B. Type "K" hard-drawn seamless copper tubing:
 - 1. Domestic water lines located under slab.
 - 2. Exterior domestic water lines 2-1/2" and smaller underground.
 - 3. Provide rolled, soft drawn type "K" seamless copper tubing for under slab and below grade where length of run between fittings exceeds maximum hard-drawn lengths.
- C. Copper Pipe Fittings:
 - 1. Provide sweat fittings, ASTM B-62, dimensions conforming to ANSI B16.22, wrought copper, with sweep patterns for copper tubing smaller than 4".
 - 2. Provide brazed fittings, ASTM B-88, dimensions conforming to ANSI B16.50, wrought copper, with sweep patterns for copper tubing, 4" and larger.
 - 3. Dielectric connection: Provide Epco Sales, lead free dielectric couplers at junction of steel pipe and equipment with copper piping systems. Use of steel or cast iron fittings in copper piping systems prohibited. T-drill branch tee connections shall not be allowed for domestic water piping.
- D. Unions to be brass ground joint, 250-pound working pressure.
- E. Nipples used in conjunction with copper pipe to be brass.

2.02 AQUATHERM GREEN PIPE

- A. Pipe shall be manufactured from a PR-R resin (Fusiolen) meeting the requirements of ASTM F 2389 as manufactured by Aquatherm. All pipe shall be made in an extrusion process. Domestic hot water shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.

- B. Fittings shall be manufactured from a PP-R resin (Fusiolen) meeting the requirements of ASTM F 2389 as manufactured by Aquatherm. All fittings shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11. Install fittings and joints using socket fusion, electrofusion, or butt-fusion as applicable. All fusion-well joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.
- C. Manufacturer shall warrant pipe and fittings for 10 years to be free of defects in materials or manufacturing.
- D. Warranty shall cover labor and material cost of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system do to defects in materials or manufacturing.
- E. Where indicated on the drawings that the pipe will be exposed to direct UV light for more than 30 days, it shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.

2.03 VALVES:

- A. Valves are specified by Manufacturer and Model Numbers to establish quality levels unless otherwise noted. Crane, Milwaukee, Hammond, Nibco, Stockham, Centerline, Apollo, Kitz, or Watts are considered equal manufacturers. Provide clamp lock hand lever operators on valves less than 8 inches. Provide hand wheel and closed housing worm gear on valves 8 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 meet NSF-61 requirements.
 - 1. Gate Valves:
 - a. Gate valves for 2-1/2" and larger steel piping systems to be Class 125, cast iron body, bronze mounted, flanged ends, Nibco F-607-RW. Valves to have solid wedge disc, outside stem and yoke with rising stem, and bolted bonnet. Provide dielectric bolt protectors at all flanges when connecting dissimilar metals.
 - b. Gate valves for copper piping 2" and smaller systems to be Class 125, bronze body, solder ends, Nibco S-113 LF. Valve to have either solid or split wedge disc, inside screw, non-rising stem, and screwed bonnet.
 - 2. Ball Valves: Ball valves for copper water piping systems 2" O.D. and smaller to be equal to Apollo "3" S-585-66LF, solder ends, and for 2-5/8" thru 3-1/8" O.D. to be equal to Nibco T T-585-66LF, threaded ends. Valves to have bronze body, chromium plated bronze ball, PTFE seats, stuffing box ring and seals, and quarter turn on-off. Provide memory stops for valves used for balancing service. Valves to be rated for 400-psi WOG at 200 degrees F. Install threaded end valves with lead free brass adapters.
 - 3. Butterfly Valves: Butterfly valves for steel water piping systems to be Crane Centerline Series 200, or approved equal industrial quality lug type with threaded holes. Valves to provide bubble-tight shut-off at 150 psi working pressure and 200 degrees F. Valves to have ductile iron body, "EPT" seats and stem seals, 316 stainless steel or bronze disc, 316 or 304 stainless steel stems. Valves 4" and larger to have weatherproofed sealed gear operator consisting of fully enclosed worm, worm gear, and worm shaft with handwheel to provide necessary torque for close-off and infinite throttling positions. Valves 3" 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.
4. Check Valves:
 - a. Check valves for copper water piping systems to be swing type, Class 125, bronze body, screwed ends, Nibco T-413-Y-LF.
 5. Flow balancing valves for domestic hot water service shall be Bell & Gossett lead free Circuit Setter Plus or approved equal. Valve shall provide flow balancing, flow measuring, and positive shutoff service. Provide valve with memory stop, capped differential pressure readout ports with internal check valves and preformed insulation. Valve construction to be bronze body and brass ball rated for 200 psig at 250 degrees F.

2.04 STRAINERS

- A. Provide cleanable "Y" type strainers in pump suction lines. Strainers to have iron body with screwed bronze or bolted iron cap. Strainer baskets to be brass. Water strainers to be Monel 20 mesh screen. Strainers to be line size complete with blow-down hose bibs. When Suction Diffusers are specified for end suction pumps, strainers are not required. Strainers to be as follows:
 1. Screwed 400# WOG – Watts LFS 77F-D1.
 2. Flanged 125# - Watts LFS 77F-D1-125.
 3. Flanged 250# - Watts LFS 77F-D1-250.
 4. Solder joint 125# - Nibco S 413-Y-LF.

2.05 HANGERS

- A. Copper piping 1/2" O.D. thru 4" O.D., with no longitudinal movement to be Grinnell Figure 260, MSS SP-69 Type 1, adjustable clevis hanger with Figure 167, MSS SP-69 TYPE 40, galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation.
- B. Non-insulated copper tubing 1/2" O.D. thru 4" O.D. with no longitudinal movement to be Grinnell Figure CT-99C, MSS SP-69 TYPE 9, plastic coated adjustable tubing ring hanger.
- C. Insulated copper piping 1/2" O.D. thru 2-1/8" O.D. with longitudinal movement to be Grinnell Figure 171, MSS SP-69 TYPE 41, pipe roll complete with Figure 167, MSS SP-69 TYPE 40, galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation.
- D. Support copper pipe risers by Grinnell Figure CT-121C, MSS SP-69 TYPE 8, plastic coated riser clamps at floor penetrations.
- E. Support three or more parallel lines by trapeze hangers utilizing Unistrut channel or equal in bottom mounting arrangement with rod hanging support.
- F. Adequately size hangers on insulated piping for insulation to pass continuously through hangers. Insulated piping to be supported outside insulation covering.
- G. Provide concrete inserts, Grinnell Figure 282, MSS SP-69 TYPE 18, universal concrete insert, for attaching hangers to building structure. Inserts to be adequately sized and correctly positioned to support piping, valves, etc., when full of water and system is in operation.
- H. Provide C-clamps with locknut, Grinnell Figure 86, MSS SP-69 TYPE 23, where

piping is to be hung from steel beams. Welding hanger rods to steel members is not permitted. Provide malleable beam clamps, Grinnell Figure 218, MSS SP-69 TYPE 30, with extension piece, Grinnell Figure 157, where piping is hung from bar joist.

- I. Attention is called to pipe spring isolation specified to be furnished by this Contractor.
- J. Support all piping by heavy steel, adjustable hangers, or brackets suitably fastened to structural portion of building. Place hangers in accordance with following tables.

COPPER TUBING SUPPORTS	
SIZE (IN.)	DISTANCE BETWEEN SUPPORTS (FT.)
5/8	6
7/8 - 1-1/8	8
1-3/8 - 2-1/8	10
2-5/8 - 5-1/8	12
6-1/8 - 8-1/8	14

- K. Perforated metal, strap iron, or band iron hangers are not permitted. Offsets in hangers are not allowed. Pipe risers to be supported at regular intervals in pipe shafts within the limits of good practice.
- L. See Insulation Section for requirements at pipe hangers.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install piping not to interfere with opening of doors or other moving parts. Do not install piping near or directly over any portion of electrical equipment.

3.02 FIRE-RATED PARTITIONS

- A. Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. Review details on drawing as well as this specification for permissible firestop systems. 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.

3.03 NON-RATED PARTITIONS

- A. 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.

3.04 PIPE SLEEVES

DOMESTIC WATER PIPING VALVES

- A. Pipe sleeves shall be provided at non-rated partitions and floor penetrations. Pipe sleeves to be Schedule 40 or 18 gage 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.
 - 1. Piping requiring sleeves: Copper pipes thru masonry walls
- B. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in finished spaces. Mechanical rooms and janitor closets are not considered "finished" spaces.
- C. Hang piping so equipment, flanges, and connections do not bear weight of piping.
- D. Adequately support vertical lines at their bases or by a suitable hanger placed in horizontal line near riser or by a base fitting set on pedestal.
- E. 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.
- F. Run piping in straight lines; riser lines to be plumb with such offsets only as indicated or necessary. No sagging of lines permitted.
- G. Unless otherwise shown on drawings, lines to be installed to drain to sumps or sewer.
- H. 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.
- I. 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.
- J. Install copper fittings with suitable flux and 95/5 lead free solder. Type K copper pipe to be joined by means of suitable flux and silver or phos-copper.
- K. Piping to have sufficient number of flanges or unions for convenient installation and removal of piping and equipment.
- L. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
- M. Install piping to prevent stresses and strains to piping and hangers from expansion or contraction. Provision for proper loops, offsets, or expansion joints to be responsibility of Contractor. Make provision for servicing and removal of equipment without dismantling piping.

3.05 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS

- A. Refer to drawings. No water piping permitted in transformer, electrical, or elevator equipment rooms.

3.06 VALVE ACCESS

- A. Locate all shutoff and control valves for easy access and operation. Where valves

must
necessarily be located in enclosed spaces, they shall be provided with access panels of sufficient size for operation. Furnish these access panels to proper trades for installation.

END OF SECTION 22 11 16

SECTION 22 11 19 DOMESTIC WATER PIPING SPECIALTIES

PART 1 – GENERAL

1.01 WORK INCLUDED

This section includes requirements for:

- A. Backflow preventers.
- B. Shock absorbers.
- C. Trap primers.
- D. Equipment connection backflow device.
- E. Vacuum breakers.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. All products used for dispensing potable drinking water must be lead free and meet the requirements of NSF 61 and NSF 372 test standards via third party testing and certification.

2.02 BACKFLOW PREVENTERS

- A. Product must meet NSF-61.
- B. Provide completely automatic, unit, fitted with tight closing shut-off valves and test cocks at each end.
- C. Construct such that all parts are replaceable without removing unit from line.
- D. Design such that total pressure drop through complete backflow preventer does not exceed 12 PSI at rated flow. Certified U.S.C. flow curves shall be provided for each device as part of the submittal package.

2.03 SHOCK ABSORBERS

- A. Refer to drawings for placement and size of shock absorbers.
- B. Access Covers: Minimum size 12" x 12" located for access to shock absorbers.

2.04 TRAP PRIMERS

- A. Construct trap primer valve of all bronze, chrome plated with removable operating parts, integral vacuum breaker, and gasketed access cover.
- B. Access Covers: Minimum size 12" x 12" located for access to trap primers.

2.05 EQUIPMENT CONNECTION BACKFLOW DEVICE

- A. Must meet ASSE 1022.
- B. Provide the above referenced backflow device if beverage equipment does not have integral backflow device.

2.06 VACUUM BREAKERS

- A. Wilkins model 420

PART 3 - EXECUTION

3.01 INSTALLATION AND TESTING

- A. Backflow Preventers:
 - 1. Pipe relief through fixed air gap and discharge to sewer. Install adjacent to wall and/or floor utilizing stand-off brackets, angle frame, and/or concrete piers.
 - 2. Test unit for leaks and pressure drop. Clean and/or replace soiled strainer media.
 - 3. Provide dual parallel reduced pressure backflow preventers on the main domestic water entrance to the facility.
 - 4. Provide backflow prevention vacuum breaker on any water line feeding any piece of equipment which could cause back siphonage such as mechanical equipment, trap primer lines, etc.
- B. Shock Absorbers:
 - 1. Install shock absorbers above ceiling, outside wall so access and maintenance can be performed without disturbing walls and non-liftouts ceilings.
 - 2. Install shock absorbers on all flush valves, solenoid valves and quick closing devices.
 - 3. Test and certify shock absorbers by plumbing and drainage institute.
 - 4. Trap Primers: Trap primers to have approval of plumbing and drainage institute.
- C. Equipment Connection Backflow device: Provide on all water lines feeding coffee makers, ice machines and beverage dispensers.
- D. Vacuum Breakers: Provide on water lines feeding equipment to protect against back siphonage of contaminated water.

END OF SECTION 22 11 19

SECTION 22 11 23 DOMESTIC WATER PUMPS

PART 1 - GENERAL AND PRODUCTS

1.1 HOT WATER RECIRCULATING PUMP

- A. Acceptable Manufacturers: Taco, Paco, or Bell and Gossett.
- B. Model number, capacity, and electrical characteristics as scheduled on drawings.
- C. Provide in-line pump with all bronze construction, flange connections, hardened steel shaft, bronze impeller, and mechanical seal.
- D. Provide flexible coupled motor with thermal overload protection Support motor from pump casing.

PART 2 – EXECUTION

2.1 INSTALLATION

- A. Verify location and clearance requirements.
- B. Install in accordance with manufacturers' published installation instructions.

2.2 START-UP AND TEST

- A. Start-up pump, verify integrity of connection, electrical phasing.
- B. Test pumps in operation under design load conditions.

END OF SECTION 22 11

SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

PART 1 – GENERAL

1.01 WORK INCLUDED



- A. Submit pipe and fittings and have approved before starting installation. Pipe and fittings to be new, and marked clearly with manufacturers' name, weight, and classification or working pressure.
- B. Piping to run approximately as shown on drawings or as structural and architectural conditions permit.

PART 2 – PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, draining tube, drawn temper. Waste, vent and drainage piping 1-1/2 and smaller.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B 16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASME B 88, Type L, water tube, drawn temper.
- D. Copper Pressure Fittings:
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. 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.
- E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8- inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.02 CAST IRON SOIL PIPE

- A. Standard weight cast iron soil pipe with drainage fittings:
 - 1. Waste, drainage, and vent lines 2" and larger. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute  and listed by NSF® International.
 - 2. Drain lines under concrete or other paving and under buildings, including to a distance of not less than 5'-0" from building. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute  and listed by NSF® International.
 - 3. Manufacturers: Charlotte Pipe and Foundry, Tyler Pipe, AB&I Foundry.

4. Joints in cast iron soil pipe may be hub and spigot with neoprene compression gaskets conforming to ASTM C564 or "No-hub". No-hub shall not be permitted on underground systems. No-hub couplings shall be standard CISPI 310 couplings manufactured with 300 series stainless steel and neoprene rubber sleeve.

2.03 PVC PIPE

- A. Schedule 40 PVC DWV pipe, ASTM D-2665 solid wall Type 1, Grade 1.
 1. Schedule 40 DWV waste and drainage piping below grade ONLY. PVC piping not permitted within Boiler Room or Kitchen.
- B. Fittings to match piping system. Fittings to have manufacturer's trademark permanently identified in accordance with MSS-SP-25. Supplier to include with submittal data certification that fittings and flanges have met requirements.
- C. Joints for piping to be made with tetrahydrofuron solvent cement. Joints to be in accordance with manufacturer's recommendations. Pipe, fittings, and cement to all be supplied by single manufacturer for entire project.
- D. All solvent cements shall be low emitting VOC at 510 g/L or less.

2.04 HANGERS

- A. Non-insulated cast iron soil pipe thru 8" to be Grinnell Figure 104, MSS SP-69 TYPE 6, adjustable swivel ring, split ring type, and pipe 10" thru 15" Grinnell Figure 260, MSS SP-69 TYPE 1, adjustable clevis hanger.
- B. Support three or more parallel lines by trapeze hangers utilizing Unistrut channel or equal in bottom mounting arrangement with rod hanging support.
- C. Adequately size hangers on insulated piping for insulation to pass continuously through hangers. Insulated piping to be supported outside insulation covering.
- D. Provide concrete inserts, Grinnell Figure 282, MSS SP-69 TYPE 18, universal concrete insert, for attaching hangers to building structure. Inserts to be adequately sized and correctly positioned to support piping, valves, etc., when full of water and system is in operation.
- E. Provide C-clamps with locknut, Grinnell Figure 86, MSS SP-69 TYPE 23, where piping is to be hung from steel beams. Welding hanger rods to steel members is not permitted. Provide malleable beam clamps, Grinnell Figure 218, MSS SP-69 TYPE 30, with extension piece, Grinnell Figure 157, where piping is hung from bar joist.
- F. Attention is called to pipe spring isolation specified to be furnished by this Contractor.
- G. Support all piping by heavy steel, adjustable hangers, or brackets suitably fastened to structural portion of building. Place hangers in accordance with the following:
 1. Cast Iron Supports: Support each fitting, at intervals of not more than 5 feet, and at least at each joint.
- H. Perforated metal, strap iron, or band iron hangers are not permitted. Offsets in hangers are not allowed. Pipe risers to be supported at regular intervals in pipe shafts within the limits of good practice.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install piping not to interfere with opening of doors or other moving parts. Do not install piping near or directly over any portion of electrical equipment.

3.02 FIRE-RATED PARTITIONS

- A. Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. Review details on drawing as well as this specification for permissible firestop systems. 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.

3.03 NON-RATED PARTITIONS

- A. 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.
- B. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in finished spaces. Mechanical rooms and janitor closets are not considered "finished" spaces.
- C. Hang piping so equipment, flanges, and connections do not bear weight of piping.
- D. Adequately support vertical lines at their bases or by a suitable hanger placed in horizontal line near riser or by a base fitting set on pedestal.
- E. 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.
- F. Run piping in straight lines; riser lines to be plumb with such offsets only as indicated or necessary. No sagging of lines permitted.
- G. Unless otherwise shown on drawings, lines to be installed to drain to sumps or sewer.
- H. 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.
- I. 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.

- J. Piping to have sufficient number of flanges or unions for convenient installation and removal of piping and equipment.
- K. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
- L. Install piping to prevent stresses and strains to piping and hangers from expansion or contraction. Provision for proper loops, offsets, or expansion joints to be responsibility of Contractor. Make provision for servicing and removal of equipment without dismantling piping.

3.04 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS

- A. Refer to drawings. No water piping permitted in transformer, electrical, or elevator equipment rooms.

3.05 GRADES AND ELEVATIONS

- A. Uniformly grade sanitary drainage lines to elevations shown. If no elevations are given, pitch sewers not less than 1/8" per foot.

END OF SECTION 22 13 16

SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES

PART 1 – GENERAL

1.01 WORK INCLUDED

This section includes requirements for:

1. Cleanouts.

PART 2 – PRODUCTS

2.01 CLEANOUTS

- A. Acceptable Manufacturer: Zurn. The following model numbers listed are Zurn.
- B. Exterior: ZN-1402-HD cast iron cutoff ferrule with round nickel bronze scoriated frame and cover, secured.
- C. Finished Concrete Floor: ZN-1400-HD inside caulk round nickel bronze scoriated frame and cover.
- D. Resilient Tile Floor: ZN-1400-X inside caulk round nickel bronze scoriated frame and cover, secured.
- E. Wall: Z-1446 cast iron cleanout with bronze plug and round stainless steel cover.
- F. Access Covers: Minimum size 12" x 12" located for access to valves, shock absorbers, trap primers, wall cleanouts, etc.
- G. Furnish cleanouts occurring in waterproof floors with clamping devices.

PART 3 – EXECUTION

3.01 INSTALLATION AND TESTING

- A. Cleanouts:
 1. Locate line size cleanouts, except 4" largest required, at base of all soil and waste stacks, at all changes in direction and in straight runs. Ensure spacing in straight runs does not exceed 50 feet inside building and 100 feet outside the building.
 2. Extend inaccessible cleanouts up through floor and/or wall provided easy accessibility cannot be obtained otherwise.

END OF SECTION 22 13 19

SECTION 22 14 00 STORM DRAINAGE


PART 1 – GENERAL

1.1 SYSTEM REQUIREMENTS

- A. Submit pipe and fittings and have approved before starting installation. Pipe, and fittings to be new, manufactured domestically, and marked clearly with manufacturers' name, weight, and classification or working pressure.
- B. Piping to run approximately as shown on drawings or as structural and architectural conditions permit.

PART 2 – PRODUCTS

2.1 CAST IRON SOIL PIPE

- A. Standard weight cast iron soil pipe with drainage fittings:
 1. Storm water piping.
 2. Rainwater leaders inside building.
 3. Drain lines under concrete or other paving and under buildings, including to a distance of not less than 5'-0" from building.
 4. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute  and listed by NSF[®] International.
 5. Joints in cast iron soil pipe may be hub and spigot with neoprene compression gaskets or "No-hub". No-hub shall not be permitted on underground systems. No-hub couplings shall be standard CISPI 310 couplings manufactured with 300 series stainless steel and neoprene rubber sleeve.

2.2 PVC PIPE

- A. Schedule 40 PVC pipe, ASTM D-1785 Type 1, Grade 1, 200-psi test:
 1. Storm water piping below grade.
- B. Fittings to match piping system. Fittings to have manufacturer's trademark permanently identified in accordance with MSS-SP-25. Supplier to include with submittal data certification that fittings and flanges have met requirements.
- C. Joints for piping to be made with tetrahydrofuron solvent cement. Joints to be in accordance with manufacturer's recommendations.
- D. Pipe, fittings, and cement to all be supplied by single manufacturer for entire project.
- E. All solvent cements shall be low emitting VOC at 510 g/L or less.

2.3 HANGERS

- A. Non-insulated cast iron soil pipe thru 8" to be Grinnell Figure 104, MSS SP-69 TYPE 6, adjustable swivel ring, split ring type, and pipe 10" thru 15" Grinnell Figure 260, MSS SP-69 TYPE 1, adjustable clevis hanger.
- B. Support three or more parallel lines by trapeze hangers utilizing Unistrut channel or equal in bottom mounting arrangement with rod hanging support.
- C. Adequately size hangers on insulated piping for insulation to pass continuously through hangers. Insulated piping to be supported outside insulation covering.
- D. Provide concrete inserts, Grinnell Figure 282, MSS SP-69 TYPE 18, universal concrete insert, for attaching hangers to building structure. Inserts to be adequately sized and correctly positioned to support piping, valves, etc., when full of water and

system is in operation.

- E. Provide C-clamps with locknut, Grinnell Figure 86, MSS SP-69 TYPE 23, where piping is to be hung from steel beams. Welding hanger rods to steel members is not permitted. Provide malleable beam clamps, Grinnell Figure 218, MSS SP-69 TYPE 30, with extension piece, Grinnell Figure 157, where piping is hung from bar joist.
- F. Attention is called to pipe spring isolation specified to be furnished by this Contractor. Support all piping by heavy steel, adjustable hangers, or brackets suitably fastened to structural portion of building. Place hangers in accordance with the following:
 - 1. Cast Iron Supports: Support each fitting, at intervals of not more than 5 feet, and at least at each joint
- G. Perforated metal, strap iron, or band iron hangers are not permitted. Offsets in hangers are not allowed. Pipe risers to be supported at regular intervals in pipe shafts within the limits of good practice.
- H. See Insulation Section for requirements at pipe hangers.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install piping not to interfere with opening of doors or other moving parts. Do not install piping near or directly over any portion of electrical equipment.
- B. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in finished spaces. Mechanical rooms and janitor closets are not considered "finished" spaces.
- C. Hang piping so equipment, flanges, and connections do not bear weight of piping.
- D. Adequately support vertical lines at their bases or by a suitable hanger placed in horizontal line near riser or by a base fitting set on pedestal.
- E. 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.
- F. Run piping in straight lines; riser lines to be plumb with such offsets only as indicated or necessary. No sagging of lines permitted.
- G. Unless otherwise shown on drawings, lines to be installed to drain to sumps or sewer.
- H. 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.
- I. 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.
- J. Piping to have sufficient number of flanges or unions for convenient installation and removal of piping and equipment.
- K. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
- L. Install piping to prevent stresses and strains to piping and hangers from expansion or contraction. Provision for proper loops, offsets, or expansion joints to be responsibility of Contractor. Make provision for servicing and removal of equipment without dismantling piping.

3.2 FIRE-RATED PARTITIONS

- A. Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. Review details on drawing as well as this specification for permissible firestop systems. 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.

3.3 NON-RATED PARTITIONS

- A. 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.

3.4 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS

- A. Refer to drawings. No water piping permitted in transformer, electrical, or elevator equipment rooms.

3.5 GRADES AND ELEVATIONS

- A. Uniformly grade storm drainage lines to elevations shown. If no elevations are given, pitch sewers not less than 1/8" per foot.

END OF SECTION 22 14 00

SECTION 22 43 00 HEALTHCARE PLUMBING FIXTURES

PART 1 – GENERAL

1.1 MANUFACTURERS

- A. All drainage products to be Zurn no exceptions. All drains installed above slab to be complete with clamping device.
- B. Stainless steel sinks shall be Elkay no exceptions.
- C. Flush valves shall be Zurn-AV no exceptions.
- D. Pressure balancing shower valves shall be Symmons
- E. Commercial or public faucets shall be American Standard no exceptions.
- F. Gooseneck faucets shall be American Standard no exceptions. All gooseneck water supply spouts for lavatories and sinks shall discharge a minimum of 5" above the rim of the specified fixture. All gooseneck faucets shall be furnished with plain end spouts; aerators shall not be accepted. An in-line flow control device to limit flow to 1.5 GPM maximum shall be installed on all gooseneck faucets, including gooseneck sensor faucets unless otherwise called for on specific fixtures.
- G. Fixture supplies, stops, and traps to be commercial grade Proflo. Traps to be 17 gauge with wall flange. Supplies to be flexible stainless steel supply lines and stops to be Proflo quarter turn compression stops.
- H. Water closet seats shall be Kohler, no exceptions.
- I. Thermostatic master mixing valves shall be Symmons, Powers, or Leonard.
- J. China or enamel fixtures to be white in color
- K. All wall-mounted lavatories shall be capable of supporting a minimum vertical load of 250 pounds. Install wall-mounted lavatories with floor-anchored carriers which fit in standard stud walls.
- L. All bariatric fixtures shall be capable of supporting a minimum vertical load of 1000 pounds. Install wall-mounted bariatric lavatories and water closets with floor-anchored carriers.
- M. All water supply spouts for lavatories and sinks shall discharge a minimum of 1" above the rim of the specified fixture.
- N. Where blade handles are specified, they shall not be less than 3-1/2", or more than 4-1/2" in length, except that handles of clinical sinks shall not be less than 6" long.
- O. All products used for dispensing potable drinking water must be lead free and meet the requirements of NSF 61 and NSF 372 test standards via third party testing and certification.
- P. Vendura Solid Surface Shower receptacles no exceptions. Fixture color to be Bone per HCA design team.

PART 2 – PRODUCTS

2.1 FIXTURES

- P-1 Water Closet - Public, Floor Mounted, Barrier-Free, 1.6 Gallon:
Zurn Z5665 HET Series 1.6 gpf floor mounted top spud bowl
Zurn Z5955SS-EL Elongated Toilet Seat w/ check hinge
Zurn Z6000AV Exposed 1.6 gpf flush valve
- P-2 Lavatory, Floor mount, Concealed Arm, Patient, Barrier-Free, Gooseneck:
Zurn Z1231 Concealed Arm System Wall Lavatories
Zurn Z5314 White 20x18 4cc wall mount lavatory
Zurn Z812A4-XL-FC1.5 CP 1.5gpm, GN wrist blade handle, plain end spout
Proflo PFGD101 1-1/4x6 CP 17ga offset grid drain
Proflo PFPTB400 1-1/4" 17ga P trap
Proflo PFXQAC32C ¼ turn angle stop
(2) Proflo PFX146324 20" Flex SS riser (2) Proflo PFE7 ½" CP escutcheon (2)
Proflo PF203WH Trap wrap
- P-3 Hand Sink, Integrated Bowl, Gooseneck Faucet :
Zurn Z812A4-XL-FC1.5 CP 1.5gpm, GN wrist blade handle, plain end
Thermostatic mixing valve, SS trap cover and chrome P-trap.
Proflo PFXQAC32C ¼ turn angle stop
(2) Proflo PFX146324 20" Flex SS riser
(2) Proflo PFE7 ½" CP escutcheon (2)
- P-4 Two Compartment Sink, Integrated Bowl, Gooseneck Faucet :
Zurn Z812A4-XL-FC1.5 CP 1.5gpm, GN wrist blade handle, plain end
Kohler K-5818-3-0 33"x22" top mount sink
Thermostatic mixing valve, SS trap cover and chrome P-trap.
Proflo PFXQAC32C ¼ turn angle stop
(2) Proflo PFX146324 20" Flex SS riser
(2) Proflo PFE7 ½" CP escutcheon (2)
- P-5 Shower:
Zurn Z7000 handheld shower and mounting bar, 2.5 gpm head
American Standard A8009D-FCO.020
Bradley S19-2100 thermostatic control valve
- P-6 Drinking Fountain w/ Bottle Filler,
Elkay LVRGRNTL8WSC with stainless steel finish
Elkay LZWSR bottle filler
Proflo PFXQAC32C ¼ turn angle valve
(1) Proflo PFX146324 20" Flex riser (1)
Proflo PFE 7 ½ OD escutcheon (1) Proflo PFPTB400 1-1/4" 17ga P trap
- P-7 Mop Basin,

Fiat MSB3624100 36"x24" molded stone mop basin
American Standard 8344.212.000 wall mounted faucet.

- P-8 Emergency Eyewash/Shower:
Bradley S19314EW shower and eyewash, manual close valves
Bradley S19-2100 thermostatic control valve
- P-9 Scrub Sink, Knee Operated:
Zurn Z5468 with wall hanger/supportbrackets
Future Health Concepts FHCSS32 single scrub sink
Proflo PFXQAC32C ¼ turn angle valve(2) Proflo PFX146324 20" flex riser(2)
Proflo PFE7 ½" CP escutcheon(2)
- P-10 Decontamination Room Shower –Interior
Symmons 125-VT-FSX-R-72 Visu-temp shower faucet, with 6 FT. vinyl hose and Attachment hooks
- P-11 Water Closet - Public, Floor Mounted, Barrier-Free, 1.6 Gallon, Bariatric:
American Standard 3641.001.020 1.6 gpf flushometer toilet
American Standard 6047.161.002 1.6 gpf flush valve
- P-12 Lavatory, Wall Hung, Bariatric, Barrier-Free, Gooseneck:
Willoughby BHS-3123 ADA bariatric wall mount lavatory with drain
Zurn Z812A4-XL-FC1.5 CP 1.5gpm, GN wrist blade handle, plain end spout
Proflo PFPTB400 1-1/4" 17ga P trap
AC32C ¼ turn angle stop (2)
ProfloPFX146324 20" Flex SS riser (2)
Proflo PFE7 ½" CP escutcheon (2)
Zurn ZZ1224 wall carrier
- P-13 Ligature Resistant Single-Station Lavatory:
Whitewall Ligature Resistant Faucet w/ push button thermostatic mixing valve, SS trap cover and chrome P-trap.
Proflo PFXQAC32C ¼ turn angle stop
(2) Proflo PFX146324 20" Flex SS riser
(2) Proflo PFE7 ½" CP escutcheon (2)
- P-14 Emergency Eye Wash Station:
Bradley S19-44011ABC wall mount
Bradley S19-2000 thermostatic mixing valve
- P-15 Ice Machine Connection:
Oatey No. 39140 metal ice maker box with metal face plate. Box with valve and water hammer arrestor

WH Wall Hydrant,Exterior:

J.R. Smith 5609QT, non-freeze with vacuum breaker and stainless steel face, loose key, quarter turn
Install 18" above finished grade

- FD Floor Drain, Regular:
Zurn Z415-SZ1-DP Type 'S' strainer, nickel bronze top, trap primer, sediment bucket
- FS Floor Sink, Regular:
Zurn Z1749, trap primer, sediment bucket
- RD Roof Drain, Overflow:
Zurn ZA-100-W2-DR, aluminum dome, adjustable drain riser extension assembly, internal 2" dam

PART 3 – EXECUTION

3.1 REQUIREMENTS

- A. Water closets shall be installed complete with wall carriers, wax rings, bolt caps, and flush valves (or float valves).
- B. Elevated vacuum breakers, where specified, shall be installed 7'-6" above the finished floor.
- C. Countertop sinks shall be installed complete with required mounting rim or clips.
- D. After installation, all fixtures shall be cleaned and labels removed. Where fixtures are in contact with walls, floors, or countertops, caulking shall be applied. Caulking shall be General Electric white silicon sanitary sealant.
- E. Water closets identified on plans as barrier free fixtures shall have the flush valves installed per American Disabilities Act. Flush valves shall have the handle installed on the wide side of the stall. Coordinate with the architectural drawings.
- F. Non pre-fabricated showers shall have chloraloy 240 brand non-plasticized chlorinated polyethylene concealed waterproofing membrane .040 inch thick. Installation shall be per manufacturer's recommendations.
- G. At each floor drain installed above slab on grade, install a 36" x 36" apron equal to chloraloy 240 brand non-plasticized chlorinated polyethylene concealed waterproofing membrane, .040 inch thick, waterproofing membrane to be installed per manufacturer's recommendations.
- H. At each flush valve, solenoid valve and other quick closing devices provide shock absorber.

END OF SECTION 22 43 00

SECTION 22 45 00 EMERGENCY PLUMBING FIXTURES

PART 1 –GENERAL

1.01 MANUFACTURERS

- A. All drainage products to be Zurn no exceptions. All drains installed above slab to be complete with clamping device.
- B. Fixture supplies, stops, and traps to be commercial grade Zurn, no exceptions. Traps to be 17 gauge with wall flange. Supplies and stops to be heavy pattern with wheel handle unless noted otherwise.
- C. Thermostatic mixing valves shall be Symmons, Holby, Powers, Bradley, or Leonard.

PART 2 – PRODUCTS

2.01 FIXTURES

P-8 Emergency Eyewash/Shower:
 Bradley S19314EW shower and eyewash, manual close
 valves
 Bradley S19-2100 thermostatic control valve

P-14 Emergency Eye Wash Station:
 Bradley S19-44011ABC wall mount
 Bradley S19-2000 thermostatic mixing valve

PART 3 – EXECUTION

3.1 REQUIREMENTS

- A. Elevated vacuum breakers, where specified, shall be installed 7'-6" above the finished floor.
- B. After installation, all fixtures shall be cleaned and labels removed. Where fixtures are in contact with walls, floors, or countertops, caulking shall be applied. Caulking shall be General Electric white silicon sanitary sealant.

END OF SECTION 22 45 00

SECTION 22 47 00 DRINKING FOUNTAINS & WATER COOLERS

PART 1 –GENERAL

1.1 MANUFACTURERS

- A. All drainage products to be Zurn no exceptions. All drains installed above slab to be complete with clamping device.
- B. Fixture supplies, stops, and traps to be commercial grade Zurn, no exceptions. Traps to be 17 gauge with wall flange. Supplies and stops to be heavy pattern with wheel handle unless noted otherwise.
- C. All products used for dispensing potable drinking water must be lead free and meet the requirements of NSF 61 and NSF 372 test standards via third party testing and certification.

PART 2 – PRODUCTS

2.1 FIXTURES

- P-6 Drinking Fountain w/ Bottle Filler,
Elkay LVRCGRNTL8WSC with stainless steel finish
Elkay LZWSR bottle filler
Proflo PFXQAC32C ¼ turn angle valve
(1) Proflo PFX146324 20" Flex riser (1)
Proflo PFE 7 ½ OD escutcheon (1) Proflo PFPTB400 1-
1/4" 17ga P trap
Install with lower bubbler 36" above finished floor
Provide ADA cane guard

PART 3 – EXECUTION

3.1 REQUIREMENTS

- A. After installation, all fixtures shall be cleaned and labels removed. Where fixtures are in contact with walls, floors, or countertops, caulking shall be applied. Caulking shall be General Electric white silicon sanitary sealant.

END OF SECTION 22 47 00

SECTION 22 60 06 CERTIFICATION PROCEDURE FOR MEDICAL GAS PIPELINES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. This section is to outline the responsibilities and procedures to be followed in final certification of the medical gas pipelines and included as a supplement to Section 22 60 05 Medical Gas Piping System.
- B. When new piping is "cut-in" to previously installed piping, it is possible that previously installed piping could be disturbed so as to cause crossed piping in previously installed systems. It is imperative that previously installed systems be inspected for crossed piping in conjunction with new system medical gas pipeline inspection and certification to the point of source.
- C. The certification procedure shall comply with all requirements of NFPA 99, latest published edition and as stated herein.
- D. Pipeline certification shall be performed by an independent third party Certification Agency. The Certification Agency qualifications data to be submitted and approved before any work to certify the systems has been performed.

PART 2 – PRODUCTS

2.1 Refer to Section 22 60 13 Medical Gas Piping System.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The General Contractor shall furnish a verified list designating number and location of all medical gas outlets to the Certification Agent. The General Contractor shall review and check this list with the appropriate subcontractors and the medical gas system personnel performing the medical gas pipeline inspection.
- B. The Plumbing Contractor is to perform mechanical check of all medical gas outlets prior to the certification inspection. Any necessary repairs or rework to be done prior to system suppliers inspection. Check to include:
 1. Outlets properly supported.
 2. Installation complete.
 3. Appropriate adapters fit and securely lock in place.
- C. The Owner is responsible for ensuring that bulk tank and/or cylinder supplies are installed, connected, and filled (or partially filled) prior to system suppliers inspection.
- D. All medical gas outlets shall be tested by the Certification Agent, excluding none.
- E. Certification Agent shall provide factory trained, qualified representatives to perform pipeline inspection and to provide report and certification in accordance with NFPA 99, latest published edition.
 1. Any discrepancies discovered during the inspection shall be noted, corrected, and any and all portions of the system affected by corrective action shall be retested and findings recorded after retest.

- F. Plumbing Contractor to provide representative who shall serve as customer contact person and who shall witness the inspection and certify that all outlets on the list furnished by the General Contractor have been checked and is in accord with inspection procedure and findings as witnessed.
- G. Hospital Engineering Department shall provide a representative who shall witness the inspection and certify that all spaces and the outlets therein listed on the list furnished by the General Contractor have been checked in accordance with inspection procedure.
- H. Certification Agent shall perform a cross connection test on all medical gas outlets using oil-free nitrogen as described in NFPA 99, latest published edition. Each pipe system shall be reduced to atmospheric pressure. Certification Agent shall then pressurize and test each piping system, one system at a time.
- I. Contractor shall connect all designated gas systems and purge the systems, completely. Certification Agent shall then analyze each medical gas outlet for proper oxygen content.
- J. The Certification Agent to furnish copies of Medical Gas Pipeline Inspection Report and Medical Gas Pipeline Certification to General Contractor to be distributed as follows:
 - 1. Plumbing Contractor
 - 2. Owner's Construction Manager
 - 3. Consulting Engineer
 - 4. Hospital
- K. The following procedure should be followed in addition to the above on extensions to existing systems:
 - 1. Owner's Representative shall, with adequate advance notice, request that system supplier's inspector or inspection team be on-site when old piping is cut-in for installation of new lines.
 - 2. Owner's Representative and system supplier's representative shall arrange to have inspector or inspection team on-site when the existing piping is cut into for installation of new lines.
 - 3. Main line shut-off vales shall be installed in new piping as close as possible to point of cut- in to previously installed piping.
 - 4. NOTE: Following verification of proper labeling or proper gas distribution of previously installed piping after cut-in procedure, the aforementioned valves (Item 3) shall be considered the "source" of supply for the new piping.

GAS ANALYSIS		
Gas	Concentration (%)	Pressure (psig)
Oxygen	99-100	50 +/- 5
Vacuum	–	Negative
Air	19.5 - 23.5 O2 content	50 +/- 5

END OF SECTION 22 60 06

SECTION 22 60 13 MEDICAL GAS PIPING SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and test the following systems:
 - 1. Oxygen (O₂).
 - 2. Vacuum (V).
 - 3. Medical/clinical compressed air (A).
- B. Outlets, valve boxes, valves, alarm systems, pressure and vacuum switches, and miscellaneous accessories for complete systems.
- C. Oxygen manifold system.
- D. Air manifold system.
- E. Pressure testing, cross connection testing and final testing, including purging and analyzing.
- F. Electrical power wiring for ceiling, alarms, vacuum pumps, and other electrical accessories associated with the system shall be furnished and installed under Division 26.
- G. Medical gas contractor shall furnish and install all low voltage control raceways and wiring associated with alarms and controls.

1.2 CODE COMPLIANCE/QUALITY ASSURANCE

- A. Install in compliance with the recommendations of the National Fire Protection Association (NFPA) as set forth in locally enforced editions of NFPA 99, Latest Edition, and NFPA 50.
- B. Comply with all local, state or federal codes applicable in this jurisdiction.
- C. Employ only qualified journeymen for this work. Employ a competent qualified mechanic/piping foreman, who has satisfactorily completed at least five other similar hospital installations, for this work. Provide brazers performance qualification test records for each brazer used on installation.

1.3 COORDINATION

- A. Coordinate with other trades to assure timely installations and to avoid conflicts and interference.
- B. Work closely with the metal stud partition installer and/or mason to assure that anchors, sleeves and similar items are provided in sufficient time to avoid delays; chases and openings are properly sized and prepared.
- C. Coordinate layout of medical gas systems in all spaces and identify all piping accurately.

PART 2 – PRODUCT

2.1 ACCEPTABLE MANUFACTURERS

- A. Piping System Components:
 - 1. Allied Health Products
 - 2. AMICO Corporation
 - 3. Puritan Bennett

4. Beacon Medical Systems

2.2 QUALIFICATION OF MANUFACTURER

A. Pipeline System Components:

1. One manufacturer shall supply the medical gas piping system(s) equipment to include outlets, valves and gauges, valve boxes, alarm boxes, air manifold system, and oxygen manifold system.
2. This manufacturer shall have a pipeline system engineer or product specialist available to periodically check with the contractor during installation of pipeline system equipment and provide a service organization to certify the system. The contractor may use a third party certification agency at his discretion.
3. Provide ongoing service support to the hospital after turnover to the Owner.
4. Provide a service organization with staffing during working days, and repair parts, within 200 miles of the facility.

2.3 PIPING MATERIALS AND HANGERS

- A. Piping: All piping including vacuum shall be seamless Type K or L (ASTM B819) copper tubing, pre-cleaned for oxygen use, in accordance with NFPA 9. Piping shall be pre-cleaned, marked and plugged by supplier before shipment to job site. Any system operating above 200 psi shall have Type K tubing.
- B. Fittings: Wrought copper, brass or bronze designed expressly for brazed connection. All fittings shall comply with ANSI B16.22. Cast fittings shall not be used. T-drill branch tee connections shall not be allowed for medical gas piping.
- C. Brazing alloy: Melting point of at least 1000 degrees F.
- D. Flux: Do not use for copper-to-copper joints. Use flux for joining copper to brass or bronze. In those cases where flux is used, exercise particular care in applying the flux to avoid leaving any excess inside the completed joints.
- E. Pipe hangers shall be copper coated adjustable swivel ring, typical of B-Line B3170CT. Strut systems may be incorporated with rubber isolators, typical of B-Line Vibra Cushion or Vibra Clamp pipe clamps. The taping of pipes for isolation shall not be permitted. Medical gas piping within metal stud walls shall be supported with plastic isolators such as Pipe-Tytes System or equivalent.

2.4 HIGH PRESSURE CYLINDER MANIFOLDS

- A. Provide automatic manifold control including self-shifting to reserve bank on exhaustion of the primary service bank and automatic reset of replaced bank to reserve status. Incorporate pressure switches for the purpose of actuating designated signals when the primary service bank is exhausted. Incorporate in control unit a visible means of determining when either bank is exhausted and operation has automatically switched to "reserve in use". Visible indication shall be by red light over exhausted bank and by gauges showing remainder pressure in each bank. Continuous visible indication of electrical circuits in effective operation shall be by means of green light. Line pressure shall be shown by separate visible gauge. Manifolds shall be installed as shown on drawings.
- B. Medical Air (A) manifold: to accommodate 6 cylinders divided into 2 equal banks.
- C. Oxygen (O₂) manifold: to accommodate 12 cylinders divided into 2 equal banks.

2.5 MEDICAL GAS OUTLET STATIONS

- A. Quick-Connect Recessed Wall Outlets:

1. Medical Gas Outlet Stations shall be modular, Quick-Disconnect recessed type. Modular outlet stations shall be field-assembled with sequences and services indicated on the plans. Centerline spacing of multiple outlets shall be 5 inches minimum.
2. Outlet stations for medical gases shall have a stainless steel faceplate mounted on a chrome-plated, zinc die-cast cover plate. The cover plate assembly shall contain the quick-connect latch release mechanism, indexing pins for safety keying the gas-specific cover plate to the appropriate rough-in box, and color-coded gas service identification. The safety-keying index pins shall be permanently captured between the cover plate and latch assembly. Designs with index pins molded in plastic will not be accepted.
3. The latch mechanisms shall be designed for one-handed, single thrust mounting and one-handed finger tip release of secondary equipment. The outlet stations shall be capable of supporting common secondary equipment, including suction regulator and half-gallon collection bottle, without the use of slide brackets.
4. The cover plate shall attach to the primary valve assembly. The primary valve shall be threaded into the rough-in box separately from the cover plate to facilitate leak-testing around the valve. Designs which prevent this test will not be acceptable. The primary valve body shall be made of brass and shall be adjustable to compensate for variation in plaster thickness. Provide an O-ring within the valve to seal mating adapter plugs. Future replacement of the O-ring shall not require disassembly of the cover plate. The primary valve poppet shall be self-sealing in service, requiring no dust cap or cover.
5. Each rough-in box shall contain a base and tube assembly consisting of a Type K copper pigtail, flared to accept 1/4" ID, 3/8" O.D. supply line, brass block and base housing a secondary check valve per NFPA 99 (not required in vacuum), primary valve O-ring seal, check valve deflator spring (except vacuum), pressure testing cap plug, and plaster shield. The copper inlet tube shall be capable of rotating 360 degrees to adjust for field piping conditions.
6. Medical gas outlets shall be cleaned for oxygen service in accordance with CGA Pamphlet G-4.1. The assembly shall be capped and internal parts poly-bagged for shipment. The outlet assembly shall bear the label of listing under Re-examination Service of Underwriters' Laboratory.
7. Quantity and gas type shall be provided as indicated on plans.

2.6 MEDICAL GAS VALVING

A. Main and Base of Riser Valves (Valves Not in Boxes):

1. All valves and tubing shall be specially prepared for oxygen service and shall conform in all particulars to NFPA 99. All valves shall be a lockable ball-type, with teflon seats and adjustable stem packing gland with teflon stem seal, through 2-inch sizes. 2-1/2" to 3" valves have teflon seats and double teflon stem seal. 4-inch valves shall have Buna-N ball seats.
2. All ball valves rated at 400 psig, actuate from full "ON" to full "OFF" by 90 degrees turn of vinyl gripped valve handle. Factory installed copper tubing shall be extended sufficiently to help prevent valve seat damage during soldering.
3. Unless specifically noted or obviously required, main and riser valves located in other than public areas are not required to be installed in box.
4. Lock valves in the open position, and turn keys over to hospital maintenance upon completion of the project.

B. Area/Zone Valves (Valves in Boxes):

1. Zone valve boxes shall be constructed of extruded aluminum or 18 gauge sheet steel with air dried lacquer finish. The cover frame shall be made of anodized aluminum and attached to the box by concealed screws. The finished assembly

shall be substantially dust-tight. The frame assembly shall be capable of adjusting for variances in wall thickness up to one inch. The frame assembly shall contain an easily removable cover window with pull ring. The window shall conceal exposed piping and valves within the box and shall be labeled "Caution - Medical Gas Shut-Off Valves - Close Only in Emergency". Clean viewing space shall be provided in the window to display the gas service, the area controlled by the valve, and pressure gauges on units so equipped.

2. Frames for all valve boxes shall have uniform width for balanced appearance. Manufacturer shall provide color-coded self adhesive gas service labels for compliance with NFPA 99 labeling requirements. Apply labels to each valve within the assembly for proper gas service identification according to the manufacturer's instructions.
3. Placement of the valve within the zone valve box shall be such that the removable window cannot be replaced when any valve is closed. Factory installed Type K copper pipe extensions shall extend three (3) inches outside the valve box. Design of the valve box shall be such that valves may be removed prior to brazing, without disassembly of the box, to permit field rearrangement of valves if necessary. Valves shall be ball type, cleaned for oxygen service, supplied with capped ends, and shall operate full open to closed position with 90 degree handle rotation. Provide chrome finish on valves and piping within valve boxes.
4. Gauge model zone valve assemblies shall include 1-1/2" pressure gauges reading 0-100 psig for oxygen, nitrous oxide and air; 0-300 psi for nitrogen, and 0-30" Hg for vacuum or evacuation vacuum. The gauge port shall be equipped with removable plug for pressure testing prior to final assembly of gauge.
5. All gauge model zone valve box assemblies shall read pressure downstream and vacuum upstream of the valve per NFPA 99. Valves shall be piped left to right.

2.7 MEDICAL GAS ALARM SYSTEMS

- A. Line pressure alarms shall be of modular construction where additional modules may be field expanded. The alarm assembly shall be U.L. listed requiring 115-volt supply. Internal voltage shall be stepped down to 24 or 12 volts for control circuit power. Each service (gas or vacuum) shall be provided with an audible alarm and visual red light flasher for abnormal pressure conditions. Audible alarm may be silenced by push-button, but visual alarm will continue to flash until abnormal condition is corrected. A green light for each service shall indicate normal pressure conditions. A pressure gauge or solid state readout shall display the pressure of each service.
 1. The alarm assembly shall be recessed within standard 3-5/8" stud walls. Type "K" copper pipe (1/4" I.D.) shall be provided for connection to each service.
- B. Master alarm panel shall be of modular construction where additional modules may be field expanded. The alarm assembly shall be U.L. listed requiring 115-volt supply. Internal voltage supply shall be stepped down to 24 or 12 volts for control circuit power. Each service (gas or vacuum) shall be provided with an audible alarm and a visual red light flasher for abnormal pressure conditions. Audible alarm may be canceled but visual alarm will continue until abnormal condition is corrected. Alarm signals shall be received from master pressure switches located at the supply source downstream of the main line shutoff valves.
 1. A minimum of two master alarm panels shall be installed. Reference the drawings for locations. Panels shall be wired in parallel to the pressure switches, not in series. Control wiring between switches and alarm panels shall be in 3/4" minimum EMT conduit. Wiring shall be 22-gauge shielded, twisted pair cable equal to Belden #8451 or West Penn #452 or per manufacturer requirements.
 2. Master alarm panel shall be recessed within standard 3-5/8" stud wall.
 3. The Multi-Signal Alarm Panel functions to be as follows:

FUNCTION	
02	Changeover to reserve
02	Reserve in use
02	Reserve low
02	Line pressure high
02	Line pressure low
Air	Line pressure high
Air	Line pressure low
Vacuum	Line pressure low
Vacuum	Reserve pump in use
Air	Reserve in use
Air	General local alarms
Vacuum	Line pressure high
Vacuum	General local alarms

- C. Provide pressure and vacuum switches, as companion to each Master alarm of the Hi-Lo single-pole double-throw approved snap-acting type enclosed in a NEMA 4 watertight housing. Switches to be factory set to activate alarms as follows:
1. 02--40 psi-low and 60 psi-high
 2. Air--40 psi-low and 60 psi-high
 3. Vacuum--12" Hg-low
- D. Provide monitoring gauges in accordance with NFPA 99 for nonflammable medical gases using lettered identification labels and color coding.

PART 3 – EXECUTION

3.3 IDENTIFICATION

- A. All medical gas piping to be stenciled with name of gas, direction of flow, operating pressure, and pipe size. Stenciling to be spaced not more than 20 feet intervals and at least once in each room and each story traversed by the piping system.

3.4 INSTALLATION

- A. Copper pipe, tubing, valves, and fittings shall be pre-cleaned and prepared for medical gas service in accordance with NFPA 99, except those supplied especially prepared for such service by the manufacturer and received sealed on the job.
- B. Joints in all the piping including vacuum piping, except those at equipment requiring screwed connections, shall be made with silver brazing alloy or similar high melting point (at least 1000 degrees F) brazing metal. Silver brazing material for pipes and fittings in the medical gas system shall be Stay-Silv-15 or equal to the following: Silvaloy-15, Aircosil No. 15, or Phos- Silver-15. The silver brazing alloy shall contain a minimum of 15% silver, 80% copper, and 5% phosphorus and shall not contain cadmium alloy. The silver brazing alloy shall have a minimum of 1000 degrees F. liquidus melting point and shall have an ASTM rating of "BCuP5". The use of flux is prohibited from the making of joints between copper to copper pipes and fittings. Appropriate flux similar to "Stay-Silv-Black Flux" or "Stay-Silv-White Flux" is required between dissimilar metals such as copper to brass or bronze material, when parts are heated over a prolonged period. DURING THE BRAZING OF PIPE CONNECTIONS, THE INTERIOR OF THE PIPE SHALL BE PURGED CONTINUOUSLY WITH NITROGEN. The outside of the tube and fittings shall be cleaned by washing with hot water after assembly.
- C. Threaded joints in piping systems shall be tinned or made up with

polytetrafluorethylene (such as teflon) tape or other thread sealants suitable for oxygen service. Sealants shall be applied to the male threads only.

- D. All piping shall be supported with pipe hangers or strut systems at intervals per NFPA 99, and NOT supported by other piping. Isolation of all copper piping from dissimilar metals shall be of a firm, positive nature. Duct tape is not acceptable as isolation material. Hanger Spacing Shall be as Follows:

Pipe Size	Hanger Spacing
1/2 inch	6 feet
3/4 inch	7 feet
1 inch	8 feet
1-1/4 inch	9 feet
1-1/2 inch and larger	10 feet

- E. Install screw joints used in shutoff valves, including station outlet valves, by tinning the male thread with soft solder. Litharge and glycerin or an approved oxygen luting or sealing compound are acceptable.
- F. Use prepared flux manufactured by Handy and Harman which consists of dry boric and water boric for hard solder joints. Alcohol mixture is prohibited. Resin or petroleum base of similar paste flux may contain compounds objectionable for oxygen service and shall not be employed.
- G. After installation of the piping, but before installation of the outlet valves, blow lines clear by means of oil-free, dry air or nitrogen.
- H. Buried piping shall be adequately protected against frost, corrosion, and physical damage. Ducts or casings shall be used on all buried piping.
- I. Identification tape shall be buried approximately 18 inches above the piping, and immediately on top of the conduit.
- J. Piping exposed to physical damage shall be adequately protected.

3.5 PRESSURE TESTING

- A. After installation of the piping and valves, but before installation of the service outlets, alarm actuating switches and gauges, the line shall be blown clear by means of oil-free, dry air or nitrogen.
- B. Next, each section of the piping system shall be subjected to a test pressure of one and one-half (1-1/2) times the maximum working pressure, but not less than 150 psig, with oil-free, dry nitrogen. This test pressure shall be maintained for at least 24 hours. Then each joint shall be examined for leakage by means of soapy water or other effective means of leak detection safe for use with oxygen.
- C. All leaks shall be repaired and the section retested.
- D. After completing the testing of each individual piping system, all of the medical gas systems shall be subjected to a pressure test at one and one-half (1-1/2) times the maximum working pressure, but not less than 150 psig. The test gas shall be oil-free, dry nitrogen. The main line shut-off valve shall be closed during the test.
- E. After completion of the above test procedure the finishing assemblies of station outlets, alarms, and all components (e.g. pressure switches, gauges, relief valves, etc.) shall be installed and all medical gas piping systems shall be subjected to a 24 hour standing pressure test at 20% above the normal operating line pressure with oil-free, dry nitrogen. The main line shut-off valve shall be closed during this test.
- F. Leaks, if any, shall be located, repaired, and the system retested.
- G. To determine that no cross connection to other pipeline systems exists, reduce all systems to atmospheric pressure. Disconnect all sources to test gas from all of the

systems with the exception of the one system to be checked. Pressure this system with oil-free, dry air or nitrogen to a pressure of 50 psig. With appropriate adapters matching outlet labels, check each individual station outlet of all systems installed to determine that test gas is being dispensed from only the outlets of this system.

- H. When all medical gas piping systems have been tested, the source of test gas shall be disconnected and the proper gas source of supply connected to each respective system. Following this connection and pressurization, all outlets shall be opened in a progressive order, starting nearest the source and completing the process of purge flushing at the outlet farthest from the source. Gas shall be permitted to flow from each outlet until each system is purged of test gas used during previous tests. After completion of purge flushing of the pipeline system, the outflow from each designated and labeled oxygen outlet station, anesthesia machine, and other oxygen dispensing equipment shall be tested (using an oxygen analyzer) to confirm the presence of the desired purity of oxygen.

3.6 CROSS CONNECTION TESTING AND CERTIFICATION

A. General Requirements:

1. This section is to outline the responsibilities and procedures to be followed in final certification of the medical gas pipelines and outlets.
2. When new piping is "cut-in" to previously installed piping, it is possible that previously installed piping could be disturbed so as to cause cross connections. It is imperative that previously installed systems be inspected for crossed piping in conjunction with new system medical gas pipeline inspection and certification to the point of source.
3. The certification procedure shall comply with all requirements of NFPA 99, Latest Edition and as stated herein.
4. Pipeline certification shall be performed by an independent subcontractor (certification agent) not associated with the medical gas equipment supplier.

B. Certification Procedure:

1. The Contractor shall furnish a verified list designating number and location of all medical gas outlets to the Certification Agent. The Contractor shall review and check this list with the medical gas system personnel performing the medical gas pipeline inspection.
2. The Contractor is to perform mechanical check of all medical gas outlets prior to the certification inspection. Any necessary repairs or rework to be done prior to system suppliers inspection. Check to include:
 - a. Outlets properly supported.
 - b. Installation complete.
 - c. Appropriate adapters fit and securely lock in place.
3. The Owner is responsible for ensuring that bulk tank and/or cylinder supplies are installed, connected, and filled (or partially filled) prior to system suppliers inspection.
4. All medical gas outlets shall be tested by the Certification Agent, excluding none.
5. Certification Agent shall provide factory trained, qualified representatives to perform pipeline inspection and to provide report and certification in accordance with NFPA 99, Latest Edition.
 - a. Any discrepancies discovered during the inspection shall be noted, corrected, and any and all portions of the system affected by corrective action shall be retested and findings recorded after retest.
6. Contractor to provide representative who shall serve as customer contact person and who shall witness the inspection and certify that all outlets on the list furnished by the Contractor have been checked and is in accord with inspection procedure

- and findings as witnessed.
7. Hospital Engineering Department shall provide a representative who shall witness the inspection and certify that all spaces and the outlets therein listed on the list furnished by the Contractor have been checked in accordance with inspection procedure.
 8. Certification Agent shall perform a cross connection test on all medical gas outlets using oil-free nitrogen as described in NFPA 99, Latest Edition. Each pipe system shall be reduced to atmospheric pressure. Certification Agent shall then pressurize and test each piping system, one system at a time.
 9. Contractor shall connect all designated gas systems and purge the systems, completely. Certification Agent shall then analyze each medical gas outlet for proper oxygen content.
 10. The Certification Agent to furnish copies of Medical Gas Pipeline Inspection Report and Medical Gas Pipeline Certification to General Contractor to be distributed as follows:
 - a. Plumbing Contractor
 - b. Owner's Construction Manager
 - c. Consulting Engineer
 - d. Hospital
 11. The following procedure should be followed in addition to the above on extensions to existing systems:
 - a. Owner's Representative shall, with adequate advance notice, request that system supplier's inspector or inspection team be on-site when old piping is cut-in for installation of new lines.
 - b. Owner's Representative and system supplier's representative shall arrange to have inspector or inspection team on-site when the existing piping is cut into for installation of new lines.
 - c. Main line shut-off vales shall be installed in new piping as close as possible to the point of cut-in to existing piping.
 - d. NOTE: Following verification of proper labeling or proper gas distribution of previously installed piping after cut-in procedure, the aforementioned valves (Item 3) shall be considered the "source" of supply for the new piping.

GAS ANALYSIS		
Gas	Concentration (%)	Pressure (psig)
Oxygen	99-100	50 +/- 5
Vacuum	-	Negative
Air	19.5 - 23.5 O2 content	50 +/- 5

END OF SECTION 22 60

SECTION 22 62 19 MEDICAL VACUUM EQUIPMENT

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and test Vacuum (V) system.
- B. Pressure and vacuum switches, vacuum pump and miscellaneous accessories for complete systems.
- C. Pressure testing, cross connection testing and final testing, including purging and analyzing.
- D. Electrical power wiring for alarms, vacuum pumps, and other electrical accessories associated with the system shall be furnished and installed under Division 26.
- E. Medical gas contractor shall furnish and install all low voltage control raceways and wiring associated with alarms and controls.

1.2 CODE COMPLIANCE/QUALITY ASSURANCE

- A. Install in compliance with the recommendations of the National Fire Protection Association (NFPA) as set forth in locally enforced editions of NFPA 99, Latest Edition, and NFPA 50.
- B. Comply with all local, state or federal codes applicable in this jurisdiction.
- C. Employ only qualified journeymen for this work. Employ a competent qualified mechanic/piping foreman, who has satisfactorily completed at least five other similar hospital installations, for this work. Provide brazers performance qualification test records for each brazer used on installation.

1.3 COORDINATION

- A. Coordinate with other trades to assure timely installations and to avoid conflicts and interference.
- B. Work closely with the metal stud partition installer and/or mason to assure that anchors, sleeves and similar items are provided in sufficient time to avoid delays; chases and openings are properly sized and prepared.
- C. Coordinate layout of medical gas systems in all spaces and identify all piping accurately.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Vacuum Pump Systems:
 - 1. Allied Health Products, Chemtron Division
 - 2. Beacon Medaes
 - 3. Amico Products

2.2 QUALIFICATION OF MANUFACTURER

- A. Vacuum Pump:
 - 1. Manufacturer/supplier shall have had at least fifteen (15) years' experience in the manufacture of oil-less medical vacuum pumps.
 - 2. Provide a service organization with staffing during working days, and repair parts, within 200 miles of the facility.
 - 3. The supplier shall supply drawings for installation operating and maintenance instructions manuals, and parts lists. The supplier shall provide both warranty and

after warranty service for the total package. The service representative shall not be third party and shall be factory trained.

2.3 MEDICAL VACUUM PUMPS

- A. Medical vacuum pumps shall be a factory assembled and tested duplex package, pre-wired and pre-piped on a fabricated steel base, ready for single point connection at the job site. Specifically, there is one electrical connection, single manifold discharge connection, and one vacuum connection to hospital.
- B. The vacuum pumps shall have a rated SCFM capacity at 19" HG, horsepower and electrical requirements as scheduled on the drawings.
- C. Furnish all required accessories for installing the vacuum pump (vibration dampeners, isolation pads or springs, flex connectors on incoming and exhaust lines, etc.).
- D. The control cabinet shall be a U.L. listed NEMA 12 dustproof cabinet. The cabinet shall contain the following:
 - 1. Fusible disconnect or circuit breaker switches for each pump.
 - 2. Magnetic motor starters with thermal overload protection for each pump.
 - 3. Vacuum control switches set to maintain the vacuum level between a minimum of 19 inches H.G. and a maximum setting of 25 inches H.G.
 - 4. Thermal overload reset buttons.
 - 5. Redundant control circuit transformers.
 - 6. Hand-Off-Automatic selector switch for each pump.
 - 7. Local alarm for reserve pump operation and output signal for master alarm panel.
 - 8. Automatic alternator between pumps.
 - 9. Minimum run timers to prevent short cycle.
 - 10. Local alarm for high discharge temperature and output signal for master alarm panel.
 - 11. Vacuum gauges.
- E. The warranty for the vacuum pump system shall be 18 months from start-up or 24 months from date of shipment, whichever comes first.
- F. Motors shall be drip-proof, 40 degree C rise, 3 phase, NEMA Design B type motors.
- G. Vacuum pumps shall be claw type, air-cooled type pumps. Oil supply shall be totally recirculating. Oil separator shall be capable of removing 99.9 percent of oil from the pump exhaust. Each pump shall have isolation valving, check valves, flexible connectors, and drive enclosures.
- H. Receiver tank shall be ASME rated and galvanized coated. Receiver tank shall have drain valve and isolation valve. A three-valve bypass shall be provided to permit servicing the receiver.
- I. Vacuum pumps, control cabinet and receiver shall be a complete unit, factory assembled. The system shall be factory tested prior to shipment. Manufacturer shall provide representative to assist in system start-up at the project site.

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 22 62 19

SECTION 22 66 53 ACID WASTE, PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers as indicated in subsequent paragraphs.

1.2 EQUIPMENT

A. Corrosive Waste and Vent Piping:

1. Material: Provide Schedule 40 polypropylene pipe and fittings that conform to dimensions and tolerances per ASTM F1412. Pipe and fittings to be manufactured with a chemically resistant polypropylene material conforming to ASTM D4101.
2. Pipe:
 - a. Below grade pipe shall be either flame retardant or non-flame retardant Schedule 40 polypropylene in accordance with ASTM D4101.
 - b. Above ground pipe shall be flame retardant Schedule 40 polypropylene in accordance with ASTM D4101.
3. Fittings: All fittings shall be manufactured to Schedule 40 polypropylene pipe dimensions of a chemically resistant and fire retardant polypropylene material conforming to ASTM D4101. Polypropylene Fittings to conform to applicable tolerances in ASTM F1412.
4. Acceptable Manufacturer: U.S Shott or equal.
5. Provide tempered glass pipe, fittings and joints as manufactured by O. I. Shott or equal.

PART 2 PRODUCTS

2.1 INSTALLATION

A. Corrosive Waste and Vent Piping:

1. Joints: All joints shall be fusion except those under casework.
2. Install at minimum slope of 1/8 inch per foot.
3. Follow manufacturers' recommendation for hanging and burial.
4. Each section or floor shall be tested with not less than 10 feet head of water for 24 hours with no leaks.
5. Polypropylene pipe shall be installed with appropriate expansion loops so as to eliminate creeping and/or bowing of the pipe due to temperature changes.
6. Where polypropylene pipe penetrates fire-rated floors or walls, approved UL listed fire stops must be installed.

PART 3 EXECUTION

END OF SECTION 22 66 53

SECTION 23 05 00 COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 – GENERAL

1.1 WORK INCLUDED

Provide all labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents.

A. Principal features of work included are:

1. Heating, ventilating, and air-conditioning system.
2. Control system including low voltage control wiring and conduit.
3. Seismic bracing and anchorage for equipment, ductwork, and piping.

1.2 RELATED WORK

- A. Electrical power and interlock wiring and conduit.
- B. Laboratory equipment.

1.3 GENERAL

- A. The contract documents form a guide for a complete system. Provide all items necessary to provide a complete system but not specifically mentioned, such as hangers, transitions, offsets, and drains.
- B. Layouts indicated on drawings are diagrammatical only. Coordinate exact location of equipment, ductwork, and piping to eliminate conflict with other divisions. Designer reserves right to make reasonable changes in location of equipment, ductwork, and piping prior to construction. Coordination drawings shall be submitted prior to any equipment/systems being installed to ensure that installation conflicts between trades are minimized.
- C. Should Contractor find during progress of work that in his judgment existing conditions make desirable a modification, report such item promptly to Designer for instructions. Do not make deviations from contract documents without review of Designer.
- D. Supervise all work with a competent mechanic specifically qualified in mechanical discipline.

1.4 PERMITS

- A. Secure and pay for permits, licenses, and inspections for work under this division.

1.5 CODES

- A. Comply with all pertinent local, state, and national codes. Refer to Division 01.

1.6 STANDARDS

- A. Comply with all pertinent standards. This list is provided as a convenience to Contractor and is not to be considered all inclusive.
 1. Sheet Metal and Air-Conditioning Contractors National Association (SMACNA).
 2. American Gas Association (AGA).
 3. Air Moving and Conditioning Association (AMCA).
 4. Air-Conditioning, Heating and Refrigeration Institute (AHRI).
 5. American Society of Mechanical Engineers (ASME).
 6. American Society of Heating Refrigeration Air Conditioning Engineers (ASHRAE).

1.7 SUBMITTALS

- A. Submit for review complete brochures and shop drawings for materials and equipment proposed in accordance with Division 01.
 - 1. Brochures: Submit complete descriptions, illustrations and specification data for materials and equipment proposed. Clearly indicate proposed items when other items are shown on same sheet. Submit samples on request and/or set up for inspection. Samples will be returned to Contractor.
 - 2. Submittals shall be submitted in line by line format. Each submittal shall be provided with a cover letter and supporting documentation indicating how the submittal meets each line of the referenced specification section. All discrepancies between the construction documents and the submitted product shall be clearly identified for engineer evaluation.
 - 3. If a product other than the basis of design is rejected by the engineer for any reason, the Contractor shall provide the basis of design product at no additional cost to the Owner.
 - 4. Shop Drawings:
 - a. Control systems.
 - b. Complete equipment, ductwork, and piping systems.
 - c. Firestop systems.

1.8 PROJECT MAINTENANCE MANUALS

- A. Prior to final acceptance of project, provide Owner with bound maintenance manuals in accordance with Division 01.

1.10 PROJECT TECHNICAL INSTRUCTION

- A. Prior to final inspection of project, provide technical instruction to Owner as follows:
 - 1. Field Instruction: Provide explanation of how systems and equipment are to operate during each season and during emergencies.
 - 2. Field Demonstration: Demonstrate operation and routine maintenance for systems and equipment.
 - 3. Video: Provide digital video of all field instruction and demonstration to Owner at completion.

1.11 PROTECTION

- A. Protect all materials and equipment in accordance with Division 01.
- B. The contractor must take appropriate precautions, during construction, to prevent unnecessary dust and debris from getting into air and water handling systems by covering equipment, controls and open-ended ducts and pipes as the installation progresses.

1.12 CONSTRUCTION RECORD DOCUMENT

- A. Provide construction record documents in accordance with Division 01. Keep at the project one set of drawings and daily record changes at the time they are made. Give drawings to Owner at project completion.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. 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 work in accordance with Division 01. Coordinate locations of equipment, ductwork, and piping to eliminate conflict with other divisions.
- B. Carefully examine contract documents to be thoroughly familiar with items which require plumbing or mechanical connections and coordination.
- C. 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 in performance of contract.
- 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.

3.3 FLASHING, COUNTERFLASHING, AND SEALING

- A. Flash, counterflash, and seal ductwork and piping at penetrations of roofs and outside walls.

3.4 IDENTIFICATION

- A. Identify exposed or accessible piping with snap-on or strap-on type markers. Color code markers in accordance with ANSI. Indicate pipe contents and direction of flow on marker. Install markers on piping not more than 20 feet apart, at valves, at access panels, and at least once above each space.
- B. 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.
- C. 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.

3.5 CLEANING

- A. Thoroughly clean ductwork and equipment casings before fans and filters are operated.
- B. Repair damaged factory finishes covering all bare places and scratches.
- C. Cleaning HVAC Systems Water Piping:
 - 1. Clean all equipment and piping of iron cuttings and other foreign matter as they are installed.
 - 2. Thoroughly flush HVAC water systems with precleaning chemicals designed to

remove depositions such as pipe dope, oils, rust, mill scale, and other extraneous materials. Provide dosages of precleaner chemicals recommended by water treatment supplier and add and circulate throughout the water systems. Drain, refill, and flush water systems thoroughly until no foreign matter is observed and total alkalinity of the drain water is equal to that of the make-up water.

3.6 TESTING

- A. Test all installed equipment and systems and demonstrate proper operation. Correct and retest work found defective when tested.
- B. Thoroughly check piping system for leaks. Do not add any leak-stop compounds to the system. Make repairs to piping system with new materials. Peening, doping, or caulking of joints or holes is not acceptable.
- C. Conduct air or smoke test if in opinion of Designer reasonable cause exists to suspect leakage or low quality workmanship.
- D. Test HVAC systems water piping at a water pressure of 125 psig for two hours without leaks.
- E. Vibration Tests:
 - 1. Test vibration isolation system in accordance with methods and procedures described in the Testing, Adjusting, and Balancing Chapter in the latest edition of ASHRAE Applications Handbook.
 - 2. Verify all vibration isolation systems are free floating and not short circuited by any connection between equipment and building structure.
 - 3. Operate mechanical systems and verify visually and audibly that there is no excessive vibration or noise generated by the system.

END OF SECTION 23 05 00

SECTION 23 05 13 ELECTRIC MOTORS GENERAL

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide and install electric motors for mechanical and plumbing equipment.

1.2 SUBMITTALS

- A. Submittal data is NOT required for products under this section as separate items. It is assumed they will be reviewed with appropriate equipment submittal.

PART 2 – PRODUCTS

2.1 MOTORS

- A. Electric motors shall be new NEMA Standard, sized and designed to operate at full load and full speed continuously without causing noise, vibration, and temperature rise in excess of their rating.
- B. Motors on belt driven equipment shall have slide rails with adjusting screws for belt tension adjustment. Motors exposed to the weather shall be weather protected.
- C. Premium efficiency electric motors shall be provided for all motors 3 horsepower and greater. Any motor used with a variable speed motor controller shall be high efficiency type and VFD compatible.
- D. High efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Polyphase squirrel-cage motors rated 1 through 125 horsepower shall be tested by dynamometer method B. The efficiency shall be determined using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Guaranteed minimum full load efficiency shall be as follows:

MINIMUM NOMINAL FULL-LOAD EFFICIENCY (%)		
	Open Motors	Enclosed Motors
Number of Poles	4	4
Synchronous Speed (RPM)	1750	1750
Motor Horsepower		
3	89.5	89.5
5	89.5	89.5
7.5	91.0	91.7
10	91.7	91.7
15	93.0	92.4
20	93.0	93.0
25	93.6	93.6
30	94.1	93.6
40 – 75	94.1	94.1
100 above	95.4	95.4
Refer to Latest Edition of ASHRAE 90.1 for other motor rpm and efficiencies.		

- E. Motor sound power levels shall not be greater than recommended in NEMA M61-12.49.
- F. Motors shall be provided with drive shafts long enough to extend completely through belt sheaves.

G. Motor characteristics shall be as follows:

1. 120V/1/60 Hz: Capacitor start, open drip-proof type, ball bearing, rated 40 degrees C. continuous rise.
2. 460V/3/60 Hz: NEMA Design B, normal starting torque, single speed, squirrel cage type, open drip-proof, rated 40 degrees C. continuous rise, with ball bearings rated for B-10 life of 100,000 hours and fitted with grease fittings and relief ports. Provide motors with aluminum end brackets with steel inserts in bearing cavities.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Arrange and set motors.
- B. Line up motors on direct drive equipment using dial type gauges.
- C. Electrical Contractor to make connections and test motor for proper rotation/phasing.

3.2 ADJUSTMENTS

- A. All motors together with driven equipment shall be statically and dynamically balanced by equipment supplier, start-up representative, or this contractor using approved balancing equipment. Fan vibration should be limited to manufacturers' recommendations, but should not exceed 2 mils in any case.

END OF SECTION 23 05 13

SECTION 23 05 48 VIBRATION ISOLATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Isolate equipment as shown on drawings and specified herein with factory-fabricated vibration isolators in accordance with recommendations in the latest edition of ASHRAE Applications Handbook. Provide isolators of proper sizes and weight loading to meet the requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Kinetics Noise Control, Mason Industries, Vibration Eliminator Co., or approved substitute. Provide isolators by a single manufacturer.

2.2 FIBERGLASS OR NEOPRENE PADS

- A. Provide Kinetics Model KIP for:
 - 1. Hot water pumps.

2.3 SPRING AND RUBBER ISOLATION HANGERS

- A. Provide Kinetics Model SFH or SRH for:
 - 1. Suspended square in-line centrifugal fans (minimum 1.0" deflection).
 - 2. Horizontal fan coil units (minimum 1.0" deflection).
 - 3. First three (3) piping hangers on each side of pumps (minimum 1.5" deflection and all hot water piping in mechanical rooms (minimum 1.5" deflection).

2.4 FLEXIBLE PIPE CONNECTORS

- A. Provide Metraflex or approved substitute twin-sphere flexible rubber pipe connectors with female unions or floating flanges on piping connections to equipment subject to vibration.
- B. Provide connectors rated for 150 PSI working pressure.
- C. Provide flexible pipe connectors for the following:
 - 1. Water connections to pumps.
 - 2. Vacuum connections to vacuum pump.

2.5 SPRING VIBRATION ISOLATION ROOF CURBS

- A. Support all rooftop air handling units with spring vibration isolation roof curbs, Kinetics Model KSCR or Mason Model RSC or approved substitute. The isolation curbs shall be complete assemblies designed to resiliently support the equipment at the proper elevation and shall provide a fully enclosed, air- and weathertight system.
- B. The isolation curb shall consist of an upper support frame on which the equipment rests and a lower support assembly which is attached to the roof structure separated by freestanding unhooded laterally stable steel springs.

- C. The lower support assembly shall incorporate means of attachment to the building as well as a continuous 2" x 2" wood nailer for attachment of the roofing material. The lower support assembly shall also contain provisions for supporting rigid insulation board.
- D. Select spring isolators to provide minimum 2" operating static deflection. Space spring isolators a maximum of 96" O.C. Provide a neoprene pad under springs.
- E. Design springs with lateral stiffness greater than one times the rated vertical stiffness and minimum 50 percent overload capacity.
- F. Include an adjustment bolt to permit leveling of the equipment after installation. Each spring isolator shall be fully accessible for adjustment without interfering with the integrity of the roof.
- G. Provide isolation curb with vertical and lateral restraints as required in order to withstand the project specific wind loads as indicated on the structural drawings. Provide signed and sealed installation details for attachment to structure as part of the equipment submittal to document compliance.
- H. The isolation curb shall be air and weathertight using an elastomeric boot which is attached to the upper support frame, extends down past the wood nailer of the lower support assembly, and is counterflashed over the roof materials. Provide sloped to drain cap below any portions of the unit that are not weather tight.
- I. Provide isolation curb with cross bracing on the upper and lower assemblies as required to assure stability.

2.6 SPRING VIBRATION ISOLATION ROOF CURB RAILS

- A. Support rooftop mounted HVAC equipment with spring vibration isolation roof curb rails, Kinetics Model KSR or Mason Model CMAB or approved substitute. The isolation curb rails shall be complete assemblies and provide a fully enclosed, air and weathertight system. Coordinate locations with all trades to prevent interruption of roof drainage layout and function.
- B. Isolation curb rails shall consist of extruded aluminum or roll-formed steel top and bottom members connected with spring isolators. Provide continuous air and water seal for the entire rail perimeter. Select and space spring isolators according to weight distribution of the supported equipment.
- C. Provide means for attachment to the roof curb and the supported equipment. Provide additional stiffening members as required to assure stability. Provide vertical and lateral restraints as required in order to withstand the project specific wind loads as indicated on the structural drawings. Provide signed and sealed installation details for attachment to structure as part of the equipment submittal to document compliance.
- D. Select spring isolators to provide minimum 2" operating static deflection. Spring components shall be freestanding, unhoused, laterally stable steel springs. Design springs with lateral stiffness greater than 0.8 times the rated vertical stiffness and minimum 50 percent overload capacity.

2.7 OUTDOOR APPLICATIONS:

- A. All isolators located outside exposed to weather shall be corrosion resistant construction with hot dip galvanizing or PVC coating.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install vibration isolation in accordance with the isolator and equipment manufacturer's published installation instructions.
- B. Size vibration isolation in accordance with weight distribution, pull or the imposed torque of actual equipment provided.
- C. Set anchor bolts when concrete is placed.
 - 1. Install vibration isolation roof curb and vibration isolation roof curb rails in accordance with manufacturers' published installation instructions to provide an air and watertight seal.

END OF SECTION 23 05 48

SECTION 23 05 49 BASIC MATERIALS AND METHODS FOR HVAC

PART 1 – GENERAL

1.1 WORK INCLUDED

Work required under this section of the specifications consists of basic materials and methods applicable to work under Division 23.

PART 2 – PRODUCTS

2.1 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.

2.2 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.

2.3 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.

2.4 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.

2.5 ROOF CURBS

- A. Provide prefabricated metal roof curbs at all roof ductwork and piping penetrations and for support of all roof-mounted equipment, fans and ductwork. Construct curbs according to National Roof Contractor's Association guidelines. Prefabricated metal roof curbs shall be manufactured by ThyCurb, Custom Curb, or approved substitute.
- B. Construct curbs with minimum 18 gauge galvanized steel (14 gauge for curbs with any side longer than 4'-0" and for all curbs supporting equipment) with fully mitered and welded corners, raised 3" integral cant for roof deck insulation, integral base plate, internal reinforcing with 1" x 1" x 1/8" steel angle for curbs with any side longer than 3'-0", factory installed 1-1/2" thick, 3- pound density fiberglass insulation and factory installed pressure treated wood nailer. Minimum height of curb shall be 12" above finished roof surface. (Consult architectural plans for roof type and thickness.) Construct curbs to match slope of roof and provide a level top surface for mounting of mechanical equipment.
- C. Curb types shall be as follows:
 - 1. Fan and duct penetration curbs with standard curb construction as described above - ThyCurb Model TC.
 - 2. Equipment and ductwork support curbs with minimum 18 gauge galvanized steel shell, base plate and counterflashing, wood nailer, and internal bulkhead reinforcement - ThyCurb Model TEMS.
 - 3. Pipe penetration curbs with standard curb construction as described above and insulated metal piping cover - ThyCurb Model TC with Model TP-2 piping cover.
- D. Install curbs in strict accordance with manufacturer's published installation instructions and as detailed on the drawings. Coordinate proper curb size, construction, and base prior to fabrication.

2.6 ROOF PIPE SUPPORTS

- A. Support horizontal piping across roof with Miro Industries Roof Pillow Block Pipestands or ThyCurb or Custom Curb Pipe Support Curbs.

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION 23 05 49

SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING

PART 1 – GENERAL

1.01 WORK INCLUDED

Perform test and balance work by a Test and Balance Agency which is engaged solely in full time test and balance work, is a member of the Associated Air Balance Control (AABC) or approved equal, and is selected and employed by the General Contractor.

- A. Perform test and balance in accordance with AABC Standards.
- B. Contract to the Test and Balance Agency shall be issued by the General Contractor. 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 designer and contractor.
- C. 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 vary with the size and complexity of the job and shall be adequate for the purpose intended. Report ALL job visits in writing - MANDATORY.
- D. The TAB agency shall work in close coordination with the contractor in calibrating all airflow and water flow stations and all duct and pipe mounted differential pressure sensor / transmitters. The tests shall be documented and included in the final TAB report.
- E. The Owner has hired an independent Cx agent to commission the mechanical and controls systems serving this facility. The TAB agency should refer to Specification 23 0809 General Commissioning Requirements and 23 0810 HVAC Commissioning Procedures and Checklists, in order to be apprised of, and become familiar with his responsibilities and accountabilities throughout the Cx process.

1.2 RESPONSIBILITIES OF PROJECT CONTRACTOR

- A. The contractor shall:
 1. Provide approved Test and Balance Agency with copy of plans and specifications upon issue of construction documents.
 2. Have the building and HVAC systems in operational readiness for TAB work to begin.
 3. Correct prompt deficiencies of materials and workmanship identified as delaying completion of TAB work.
 4. Be responsible for any added costs to the owner resulting from his failure to have the building and HVAC systems ready or from his failure to correct deficiencies promptly.
- B. Complete operational readiness of the building requires that construction status of the building shall permit closing of doors, windows, ceilings installed, etc., to obtain projected operating conditions.
- C. Complete operational readiness of the air conditioning systems requires that the following be accomplished:
 1. Air Distribution Systems:
 - a. Verify installation conforms to design. All supply, return and exhaust ducts

- terminated and pressure tested for leakage as required by specifications.
 - b. All volume, control, fire and smoke dampers properly located and functional. All dampers shall be fully open. MVD gradients and spin damper handles should be exposed through insulation. Dampers serving requirements of minimum and maximum outside, return and relief air shall provide tight closure and full opening, smooth and free operation.
 - c. All supply, return, exhaust and transfer grilles, registers, diffusers, terminal boxes and filters installed.
 - d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be sealed to eliminate bypass or leakage of air.
 - e. All fans operating at full load and verified for freedom from vibration, proper fan rotation and belt tension; heater elements in motor starters to be of proper size and rating. Check motor amperage and verify that it is under nameplate rating.
2. Water Circulating Systems:
- a. Check and verify pump alignment and rotation. Verify location of thermometers, gages, and PT test plugs.
 - b. Open all valves to full open position. Close bypass stop valves. Set mixing valves to full flow through system components. Remove and clean all strainers. Verify specified pipe cleaning has taken place. Repeat operation until circulating water is clean.
 - c. Record pump motor amperage on each phase and voltage after reaching rated speed. Readings shall not exceed nameplate rating. Verify heater elements in motor starters to be of proper size and rating.
 - d. All water circulating systems shall be full and free of air; expansion tanks set for proper water level; all air vents installed at high points of systems and operating freely. System static pressure to be set minimum 5 psig above highest system elevation.
 - e. Check and set operating temperatures of heat exchangers to design requirements.
 - f. Verify that piping to coils is complete and set for counter flow. Verify location of thermometers, gauges, PT test plugs, and flow balancing/measuring valves.
3. Automatic Controls:
- a. Verify that all control components are installed and functional in accordance with project requirements, including all electrical interlocks, damper sequences, temperature resets, and safeties.
 - b. Verify that pressure controllers are calibrated and control variable speed motor controllers as required to maintain a stable pressure.
 - c. All controlling instruments calibrated and set for designed operating conditions.
4. Notification of System Readiness: After completion of the work above, the contractor shall notify the TAB firm and designer certifying that the work has been accomplished and that the building and HVAC systems are in readiness for testing, adjusting, and balancing.
- D. As part of this project contract, the contractor shall make any changes in the sheaves, belts and dampers required for correct balance as required by the TAB firm.
- E. The contractor shall provide and coordinate services of qualified, responsible contractors, suppliers and personnel as required to correct, repair, or replace any and all deficient items or conditions found during the testing, adjusting and balancing period.
- F. In order that all systems may be properly tested, balanced, and adjusted, the contractor shall operate systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB.
- G. Project schedules shall provide sufficient time to permit the completion of TAB

- services prior to owner occupancy.
- H. The plans and specifications have indicated valves, dampers and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the contractor to install these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the contractor shall provide access as requested by the TAB firm. Also, any malfunction encountered by TAB personnel shall be reported to the contractor and designer and corrected by the contractor immediately so the balancing work can proceed.
 - I. The TAB fieldwork shall not begin on any system / equipment item until signed prefunctional, startup checklists, pertaining to applicable equipment, have been submitted by the installing contractor to the Cx team

1.3 QUALIFICATIONS OF THE TAB CONTRACTOR

- A. The firm shall submit six (6) completed projects of like size and scope. Provide references for each project.
- B. The test and balance firm shall submit a resume for the individual proposed to directly supervise the project. The supervisory personnel for the test and balance firm shall be certified test and balance engineers. All project managers and technicians shall be permanent, full-time employees of the agency.
- C. The test and balance firm shall submit a list of its calibrated instrumentation to perform the work.

1.4 DOCUMENTS

- A. The contractor shall furnish to the TAB firm the following:
 - 1. One set of mechanical specifications.
 - 2. Three sets of mechanical drawings.
 - 3. All pertinent addenda and change orders.
 - 4. One set of control submittal drawings.
 - 5. Approved submittal data on equipment installed, and related changes as required to accomplish the TAB test procedures outlined below.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION

3.1 RESPONSIBILITIES OF THE TAB FIRM

- A. The TAB personnel shall check, adjust, and balance the components of the HVAC system which will result in minimum noise, specified temperature, and air flow conditions in the conditioned spaces of the building while the equipment of the system is operating economically. This is intended to be accomplished after the system components are installed and operating as provided for in the contract documents.

3.2 LIAISON AND EARLY INSPECTION

- A. The personnel on the job shall act as liaison between the owner, designer and contractor. They shall inspect the installation of piping systems, ductwork systems, control systems, and other component parts of the HVAC systems during the construction stage to verify proper arrangement and adequate provisions for the testing and balancing.
- B. During the balancing process, as abnormalities and malfunctions of equipment or components are discovered by the TAB personnel, the contractor shall be advised in writing so that the condition can be corrected by the contractor. The TAB firm shall suggest solutions to noted problems. Data from malfunctioning equipment shall not be recorded in the final TAB report.

3.3 THE TAB REPORT

- A. TAB activities shall culminate in a report to be provided in triplicate to the designer. The intent of the final report is to provide a reference of actual operating conditions for the owner's operating personnel.
- B. All measurements and recorded readings (of air, water, electricity, sound, etc.) that appear in the reports must be done on-site by permanently employed technicians or engineers of the firm.
- C. All comment sheets (punch lists) shall be signed by the contractor to acknowledge receipt. Any outstanding items at the time of completion shall be included in the report.
- D. The report shall be certified and approved by the firm's test and balance engineer. The report shall be recorded on standard forms.

3.4 ACTUAL TESTING AND BALANCING PROCEDURES

- A. Airside:
 - 1. Supply Fan:
 - a. Fans checked for rotation, amperage, static pressure, etc.
 - b. Terminal boxes set to maximum cfm and adjust supply fan to within 0% to +5% of design cfm.
 - c. Main supply duct pitot tube traverse and adjustment of fan speed to produce design cfm while maintaining minimum system static pressure for proper terminal box operation.
 - d. The report shall record the VFD speed for the supply fan.
 - 2. Return Fans:
 - a. Fans checked for rotation, amperage, static pressure, etc.
 - b. With supply system in the maximum mode, traverse and adjust return fan to within +/- 5% of design cfm.
 - c. The report shall record the VFD speed for the return fan.
 - 3. Outside Air:
 - a. Fans checked for rotation, amperage, static pressure, etc.
 - b. With supply system in the maximum mode, traverse and adjust minimum outside air damper and/or fan to design cfm.
 - 4. Exhaust Fan:
 - a. Fans checked for rotation, amperage, static pressure, etc.
 - b. With supply system in the maximum mode, traverse and adjust exhaust fan to within +/- 5% of design cfm.
 - 5. Diffusers, Registers, and Grilles:
 - a. Balance each supply air outlet to within 0% to 10% of design cfm.
 - b. Balance each return air outlet to within +/- 5% of design cfm.
 - c. Balance each exhaust air outlet to within 0% to -10% of design cfm.
 - d. 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.
6. After completion, take total air-handling system static profile and record all final statics, amperages, rpm, cfm, etc.
- B. Waterside:
1. Chilled Water:
 - a. Check system for cleanliness.
 - b. With all chilled water valves calling for full cooling, test, set and record each pump head and flow.
 - c. Test, set, and record pressure drop and flow through each chiller to within 0% to 5% of design.
 - d. Test, set and record pressure drop and flow through each flow balancing station.
 - e. Test, set and record pressure drop and flow through each cooling coil to within 0% to 5% of design.
 - f. Verify that piping system is vented.
 - g. Verify removal of pump start up strainer and replacement with operating strainer.
 2. Hot Water:
 - a. Check system for cleanliness.
 - b. With all hot water coils (including terminal box reheat coils) calling for full heating, test, set and record pump head and flow.
 - c. Test, set and record pressure drop and flow through each boiler to within 0% to 5% of design.
 - d. Test, set and record pressure drop and flow through each flow balancing station.
 - e. Test, set and record pressure drop and flow through each heating coil to within 0% to 5% of design.
 - f. Verify that piping system is vented.
 - g. Verify removal of pump start-up strainer and replacement with operating strainer.
 3. Condenser Water:
 - a. Check system for cleanliness.
 - b. With strainers clean and all valves wide open, test, set and record each pump head and flow.
 - c. Balance hot water basins in tower for even distribution.
 - d. Test, set and record pressure drop and flow through each chiller.
 - e. Verify removal of pump start-up strainer and replacement with operating strainer.
 4. Domestic Hot Water Recirculation System:
 - a. Balance recirculation pumps $\pm 5\%$ of design gpm flow.
 - b. Set balancing valves to gpm settings as noted on plumbing drawings.
- C. 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.
 - e. Record the following: The supply duct static pressure reading, VFD Hz, and fan rpm when the AHU supply fan is meeting the design airflow of all terminal units simultaneously. Also record the supply static pressure set point established and transmitted to the controls subcontractor.
 2. Chiller Controls:
 - a. Verify chiller controller is set at design chilled water temperature.
 - 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.

D. 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 with glass stem, mercury thermometer if thermometer wells are provided. If P.T. plugs are provided, use a bi-metal thermometer which reads in 1 degree F. increments and use the same thermometer for both supply and return water temperature measurements.
- d. Record final temperatures, BTU/HR. and GPM.
- e. Convert actual test conditions to design conditions to insure design coil capacities at design temperatures.

2. Heating Coils (Air Handling Unit and Preheat Only):

- 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 with glass stem, mercury thermometer if thermometer wells are provided. If P.T. plugs are provided, use a bi-metal thermometer which reads in 1 degree F. increments and use the same thermometer for both supply and return water temperature measurements.
- d. Record final temperatures, BTU/HR. and GPM.
- e. Convert actual test conditions to design conditions to insure design coil capacities at design temperatures.

3. Terminal Box Heating Coils: Test, set and record flow through terminal box heating coil.

4. 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.

5. Cooling Towers (Test performed simultaneously with chiller test):

- a. Record full load entering and leaving condenser water temperature with glass stem, mercury thermometers accurate to 1/2 degrees F.
- b. Record condensing temperature of refrigerant at time of test.
- c. Record GPM at time of test.
- d. Record a minimum of four tower inlet wet bulb readings.
- e. Record a minimum of four tower leaving wet bulb readings.
- f. Perform log-test for a minimum of one hour taking readings at least every ten minutes.
- g. Average all readings and compute actual BTU/HR. and tons rejected.
- h. Convert actual test conditions to design conditions to insure design capacity at design temperatures.

6. Thermostat Calibration:

- a. Measure and record dry and wet bulb temperatures at each thermostat.
- b. Report any thermostat which is not controlling with +/-1-1/2 degree F.

7. Control Temperature Readouts:

- a. Test actual temperature next to sensor (if possible) and compare to readout.
- b. Report any sensor which is not within +/-1-1-2 degrees F.

E. Noise Level: The TAB Contractor shall measure the HVAC background noise level in

all the spaces as follows: HVAC system produced noise shall not exceed the following levels: patient rooms, nurses stations, offices, conference rooms, LDRs, nursery, exam rooms, therapy rooms, diagnostic rooms, waiting rooms, and treatment rooms shall not exceed a NC 37; operating rooms, C-section rooms, lobbies, cafeteria, toilets, laboratories, and utility rooms shall not exceed a NC 42. NICU is NC 34.

- F. The General Contractor and the Mechanical Contractor shall be responsible for reviewing the NC curve for spaces which exceed the required levels and make appropriate adjustments to the system to bring the NC level into range. The final TAB report shall document all spaces with appropriate NC levels.

3.5 REPORTS

- A. Problems Encountered: Any items not installed, improperly installed or not functioning properly shall be reported to the contractor.
- B. Final Report:
 - 1. Any unresolved problems shall be reported in a general remarks section in front of the test and balance report.
 - 2. Any unusual operations or pertinent remarks which may aid the maintenance personnel or ease the reading of the report shall be made in the general remarks section of the report.
 - 3. All operating data and final tests shall be reported in the final report. This data shall include, but not necessarily be limited to the scope of work outlined above.
 - 4. TAB contractor shall compile an Excel spreadsheet for all terminal boxes, listing each box by its unique identification number, the inlet flow area established by the box manufacturer, the manufacturer's gain factor for the box, final TAB calibrated gain factor for the box if field calibrated, and the ratio of the calibrated gain factor to the manufacturer's gain factor.

3.6 CALLBACK

- A. Test and Balance Agency shall retest any unresolved problems noted in the final report. The revised results shall be forwarded after completion of test.
- B. At the discretion of the designer before final acceptance of the TAB report, the report data shall be verified one time on the job site by selection of random check points in the presence of the designer. Representatives of the testing firm shall be present and provide the necessary equipment for test data verifications.
- C. The firm shall be responsible for testing, adjusting, balancing, and reporting on the performance of all fans, dampers, air distribution devices, pumps and heat exchangers, the flow through all coils, pumps and heat exchangers, and the power consumption of all motors. The contractors and the suppliers of the equipment installed shall cooperate with the balancing agency to provide all necessary data on the design and proper application of the system components and shall furnish all labor and material required to eliminate any deficiency.
- D. Make one (1) inspection within ninety (90) days after occupancy of the building to insure that satisfactory conditions are being maintained.

3.7 OPPOSED SEASON TESTING

- A. This service allows for testing of equipment that, due to extreme weather conditions, cannot be accurately tested at the time of the initial balance. If a project is balanced during the summer, the opposed season testing is performed during the winter months and vice-versa.

- B. During the opposed season testing, any necessary modifications to the initial adjustment required to produce optimum operation of the system components shall be made to produce the proper seasonal conditions in each conditioned space. At the time of opposite season testing, the designer and owner shall be given timely notification before any readings or adjustments are made so that he may participate.

END OF SECTION 23 05 93

SECTION 23 07 10 INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Contractor shall provide all necessary labor, materials, tools, and equipment to perform work required on the drawings and specified herein.
- B. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials to be as specified in applicable sections of the specifications.
- C. All pipe fittings, valves, and strainers in insulated pipe systems to be insulated.
- D. Thermal resistance "R" values used herein are expressed in units of "Hour, Degrees F., Sq. Ft./BTU per Inch of Thickness" on a flat surface at a mean temperature of 75 degrees F.
- E. "Contractor's Option" referred to in Materials below indicates optional materials which may be used as equals.

1.2 DEFINITIONS

- A. "Exposed" equipment, ducts, and piping are areas which will be visible without removing ceilings or opening access panels.
- B. Outdoors is considered exposed to the weather.
- C. Underground is buried, whereas in a trench below grade is considered concealed.

1.3 CERTIFICATION/QUALITY ASSURANCE

- A. Products shall meet applicable national, state, and local building codes and be U.L. (or other recognized testing lab) listed for intended service.
- B. All insulations, jackets, adhesives, coatings, sealers, and tapes shall have a flame spread rating of 25 or less and smoke development rating of 50 or less when tested in accordance with ASTM E-84, NFPA 225, U.L. 723, and further must meet the requirements of NFPA 90-A and applicable building, plumbing, and mechanical codes.
- C. All insulation materials shall be delivered and stored in manufacturers' containers and kept free from dirt, water, chemical, and mechanical damage.
- D. Insulation shall be applied in a workmanlike manner by experienced, qualified tradesmen.
- E. Insulation shall not be applied until all pressure testing has been completed, inspected, and released for insulation application.
- F. Surfaces shall be clean and dry.
- G. Insulation joints shall be butted firmly together and all jackets and tapes shall be smoothly and securely installed.
- H. Insulation for duct, pipe, and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 1" thickness in less than 53 seconds when tested in accordance with ASTM D-1692.

1.4 APPLICABLE CODES AND STANDARDS

- A. ASTM E-84.
- B. U.L. 723.
- C. NFPA 90-A.
- D. ASHRAE 90.1
- E. Florida Energy Code.

PART 2 – PRODUCTS

2.1 MATERIALS FOR PIPE AND EQUIPMENT

- A. Materials for Pipe and Equipment: Provide factory pre-molded or shop or site mitered segment type insulation for pipe, pipe fittings, and valves. Fitting insulation to be of same thickness and material as adjoining pipe insulation. All insulation and related materials such as tape and mastic to meet applicable building code requirements for fire and smoke development.
 - 1. Flexible Tubular: Provide 25/50 rated, closed-cell, flexible tubular rubber type pipe insulation. Product to have continuous operational temperature limit of 200 degrees F. and a minimum "R" value of 3.7 per inch ($K=0.27$) at 75 degrees F mean temperature. Product to be Armstrong AP Armaflex or approved equal pipe insulation. Use flexible tubular for the following services:
 - a. Moisture condensate drains: 1" thick.
 - b. Horizontal runs of waste lines carrying cold condensate from air conditioning equipment: 1" thick.
 - c. Refrigerant suction lines for split systems: 1" thick.
 - d. Provide multiple layers as required to obtain minimum thickness.
 - 2. Fiberglass: Provide factory-formed, factory-jacketed fiberglass piping insulation. Product to be Manville "Micro-Lok 650" with "Type AP-T" jacketing or equivalent product manufactured by CertainTeed, Knauf, or Owens-Corning. Product to have continuous operational temperature limit of 850 degrees F and a minimum "R" value of 3.5 per inch thickness ($K=0.28$) at 75 degrees F mean temperature. Jacket to be fiberglass reinforced kraft paper with aluminum foil and pressure sensitive closure system. Vapor-barrier mastic for application to below ambient pipe insulation shall be fungus resistant per ASTM D 5590 with 0 growth rating; Water based; Permeance per ASTM E 96, Procedure B, 0.013 perm or less at 43-mil dry film thickness suitable for indoor and jacketed outdoor use. Products: Foster 30-80 AF. Color: White. A breather mastic for application to above ambient pipe insulation (fittings, tees, valves, etc) shall be water based Foster 46-50 mastic or Childers CP-10 / CP-11. Use fiberglass piping insulation for the following services:
 - a. Heating hot water piping: below 1-5/8" – 1-1/2" thick; 1-5/8" and greater - 2" thick.

2.2 MATERIALS FOR DUCTS

- A. Blanket Type Duct Insulation: Provide minimum 3/4 pound per cubic foot density, flexible blanket fiberglass duct insulation with FSKL aluminum foil vapor barrier facing and 2" tab. Insulation shall have minimum 'R' value of 3.4 per inch ($K=0.29$) at 75 degrees F mean temperature. Product to be Manville "Microlite" or equivalent standard duct wrap by CertainTeed, Knauf, or Owens-Corning. Use blanket type duct insulation for the following:
 - 1. Unlined heating and/or cooling supply air ductwork concealed from view: 2" thick.
- B. Board Type Duct Insulation: Provide minimum 3 pound per cubic foot density, semi-rigid fiberglass duct insulation with FSKL aluminum foil vapor barrier facing. Insulation

shall have a minimum 'R' value of 3.8 per inch (K=0.26) at 75 degrees F mean temperature. Product to be Manville "800 series Spin-Glas" or equivalent by CertainTeed, Knauf, or Owens-Corning. Use board type duct insulation for the following services:

1. Unlined exposed heating and/or cooling supply air ducts: 1-1/2" thick.
2. Unlined exposed outside air ducts: 1-1/2" thick.
3. Unlined exposed return ducts: 1-1/2" thick.
4. Unlined exposed supply, return and outside air ducts within equipment rooms or located in unconditioned space: 1-1/2" thick.
5. Apparatus casing: 1-1/2" thick.
6. Unlined supply air and return air ducts outside exposed to weather: 2" thick.
7. Unlined air-handling plenums within equipment rooms: 1-1/2" thick.
8. Side access filter housings: 1-1/2" thick.

2.3 MATERIALS FOR FITTINGS, VALVES, AND SPECIAL COVERINGS

- A. Provide coverings and finishes for specific items hereinafter specified.
 1. Use pre-molded insulation fabricated by the manufacturer of insulation material or shop or site mitered segment type insulation for: All pipe fittings, elbows, tees, valves, and couplings.
 2. PVC fitting covers over blanket fiberglass are NOT acceptable.
 3. Contractor's option to provide factory pre-molded one-piece PVC insulated fitting covers, precut fiberglass insulation inserts, and necessary installation materials for all pipe fittings. Materials to be equal to Manville Zeston white, U.V. resistant, 25/50 rated, 20 mil thickness insulated PVC fitting covers and insulation inserts.
 4. PVC fitting covers over blanket fiberglass are not acceptable for steam, gravity steam condensate, and steam boiler/deaerator piping services.
 5. Insulation is not required for hot water system strainers, relief valves, and steam pressure reducing valves. Insulate piping to within 3" of uninsulated items.
- B. For heat exchangers, air separators, large pipes, etc., in systems operating over 60 degrees F., when exposed-to-view inside building or in equipment rooms, cover insulation with a smoothing coat of Keane Powerhouse cement, one layer of white colored glass mesh embedded and finished with Foster 46-50 mastic or Childers CP-10 / CP-11 mastic.
- C. For pipe fittings, valves, strainers, air separators, and other irregular surfaces, in systems operating below 60 degrees F., when exposed to view inside building or in equipment rooms, cover insulation with white colored glass mesh embedded in white, fungus resistant vapor barrier coating Foster 30-80 AF. Coating shall meet ASTM D 5590 with 0 growth rating.
- D. Fabricate and install readily removable insulation caps to facilitate service and maintenance accessibility to all strainers including suction diffusers in systems operating below 60 degrees F.
- E. For any service, when below grade direct buried, cover straight pipe and fitting insulation with equivalent of Pittsburgh Corning "Pittwrap", Foster C.I. Wrap 50 or "Pittwrap SS11" jacketing. Valves in systems operating above 60 degrees F. and installed in valve boxes shall not be insulated; however, the valves shall be painted with a rust resistant product equivalent to Rustoleum.
- F. For flexible tubular pipe and fitting insulation when exposed-to-view inside building or exposed to the weather, finish with two coats of paint, custom color blended to match surrounding surfaces.
- G. When specifically approved by designer, when it is impossible to completely insulate pipe, fittings, or valves with specified insulation, Armstrong Armaflex insulation tape may be used to prevent condensate drip on small piping. Use of cork insulation tape is

prohibited.

PART 3 – EXECUTION

3.1 GENERAL

- A. No insulation shall be cut where a hanger is located. If hangers have been installed by pipefitter tradesmen which violates this strict requirement, notify Designer immediately.
- B. Piping and ductwork systems shall be tested and found free of all leaks prior to installation of insulation covering.
- C. All surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and during application of any finish, unless such finish specifically requires a wetted surface for application.
- D. All adhesives, cements, and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.
- E. Install insulation using professional insulators who have adequate experience and ability.
- F. Exposed-to-view insulation shall have a well tailored appearance.
- G. See Section 23 21 13 for sleeves and insulation requirements.
- H. Stop all duct coverings, including jacket and insulation, at fire and smoke dampered penetrations of partitions. "Fan-Out" or extend jacketed insulation at least 2" beyond angle frames of dampers and secure insulation to partition. Maintain vapor barrier. Where insulated duct access door is not used, install covering over damper access panel so as to be readily removable and identifiable.
- I. Treat insulated pipe and duct surfaces in equipment rooms and where exposed to normal view, so surfaces may be painted with water base latex paint. Use of mastics, adhesives, or jacketing which cause "bleeding" is prohibited.

3.2 INSTALLATION OF DUCT COVERING

- A. Apply jacketed blanket type fiberglass covering to ducts pulled snug but not so tight as to compress corners more than 1/4". Use insulation having 2" tab, or cut insulation long enough to allow for "peel off" of insulation from jacket to effect a minimum overlap of 2". Secure 2" jacket laps using equivalent of Foster 85-75 or CP-82 adhesive and staple lap with flare type staples on 2" centers. Cover standing seams, stiffeners, and braces with same insulation blanket, using 2" jacket lap and staple lap as hereinbefore outlined. Cover and seal all staples with Foster 30/80 AF, fire resistant vapor barrier coating reinforced with glass cloth.
- B. For duct 24" or wider, mechanically fasten insulation to duct bottom, using weld pins or nylon "stick-clip" base plates having self-locking coated metal or nylon discs. Locate fasteners on not over 12" centers laterally and longitudinally. Seal pins as above.
- C. For ducts more than 20" deep, mechanically fasten insulation to duct sides, using one row of pins, plates, or discs located on not over 12" centers longitudinally and equidistant laterally between duct top and bottom. For ducts over 24" deep, apply fasteners as before only using minimum of two rows.
- D. Apply jacketed board type fiberglass covering to ducts using weld pins or nylon "stick-clip" base plates having self-locking coated metal or nylon discs. Locate fasteners on not over 12" centers laterally and longitudinally. If insulation is grooved to fit around

corners, in order to eliminate as many joints as possible, pin as required to hold insulation tight to duct, especially on bottom of duct. Seal pins and joints with Foster 30-80 AF reinforced with glass mesh.

- E. Cover all joints, rips, tears, punctures, disc heads, staples, or breaks in vapor barrier jacket with 4" wide woven glass fabric tape embedded in Foster 30-80 AF fire resistant vapor barrier coating. PRESSURE SENSITIVE TAPE NOT ALLOWED.
- F. Prior to application of flexible sheet insulation, thoroughly clean all metal surfaces, making sure that all dirt, scale, loose paint, plaster, and oil have been removed and that surfaces are dry. If surface has been primed, test a 2 square foot section using adhesive equivalent to Armstrong 520, Foster 85-75 or Childers CP-82 in order to determine whether solvent in adhesive will loosen or lift the primer. If primer is loosened, then remove it. When testing proves acceptable, adhere insulation with smooth side out, using thin but adequate coating of same adhesive. Follow manufacturers' instructions. Coat all butt edges of each sheet. Stagger all joints. Insulate all standing seams or flanges with same thickness of insulating material as that used on main surface. Seal all butt joints, miter joints, and torn or damaged insulation with adhesive.
- G. Ductwork manual volume damper (MVD) handles, airflow station pressure ports, access door handles, duct-mounted instrumentation, etc., shall be left exposed and/or accessible above the insulation vapor barrier.

3.3 INSTALLATION OF PIPE AND EQUIPMENT COVERING

- A. Where fiberglass or flexible tubular insulation is used on piping sized 2" and larger, insert a section of foamglass insulation at hanger or support points between pipe and metal shield for full length of shield to prevent crushing of insulation. Insulation thickness to be same as adjoining insulation. Where insulation passes through pipe hangers and across trapeze supports, 12" long metal saddles shall be used. On cold pipe, vapor barrier should be carried through the hanger and sealed.
- B. Apply flexible tubular insulation to pipe and fittings using the slip-on method with all joints tightly fitted and sealed with Armstrong 520, Foster 85-75, Childers CP-82 adhesive or approved equal. Seal butt joints, miter joints and torn or damaged insulation with adhesive.
- C. Prior to application of flexible sheet insulation, thoroughly clean all metal surfaces, making sure that all dirt, scale, loose paint, plaster, and oil have been removed and that surfaces are dry. If surface has been primed, test a 2 square foot section using adhesive equivalent to Armstrong No. 520, Foster 85-75, Childers CP-82 in order to determine whether solvent in adhesive will loosen or lift the primer. If primer is loosened, then remove it. When testing proves acceptable, adhere insulation with smooth side out, using thin but adequate coating of same adhesive. Follow manufacturers' instructions. Coat all butt edges of each sheet. Stagger all joints. Insulate all standing seams or flanges with same thickness of insulation material as that used on main surface.
- D. All hot water and chilled water pump casings shall be insulated with readily removable insulation sections that allow easy access to all pump components, pressure gauges, P/T ports, etc., requiring testing or maintenance access.
- E. Piping insulation on in-line mounted P/T ports, circuit setting pressure ports, calibrated balancing valve pressure ports, etc., shall be made easily removable so that access to the ports can be readily obtained without destroying the insulation.

END OF SECTION 23 07 10

SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. HVAC commissioning description.
 - 2. HVAC commissioning responsibilities.

1.2 RELATED SECTIONS:

- A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: For requirements and procedures concerning testing, adjusting, and balancing of mechanical systems.
- B. Section 23 09 23 - Direct-Digital Control System for HVAC: Submittal, training, and programming requirements.

1.3 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE Guideline 1 - The HVAC Commissioning Process.
- B. Building Commissioning Association:
 - 1. BCA - Commissioning Handbook.
- C. National Environmental Balancing Bureau:
 - 1. NEBB - Procedural Standards for Building Systems Commissioning.
- D. Testing Adjusting and Balancing Bureau:
 - 1. TABB - Commissioning Manual.

1.4 COMMISSIONING DESCRIPTION

- A. HVAC commissioning process includes the following tasks:
 - 1. Testing and startup of HVAC equipment and systems.
 - 2. Equipment and system verification checks.
 - 3. Assistance in functional performance testing to verify testing and balancing, and equipment and system performance.
 - 4. Provide qualified personnel to assist in commissioning tests, including seasonal testing.
 - 5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
 - 6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
 - 7. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
 - 8. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
 - 9. Provide training for systems specified in this Section with coordination by Commissioning Authority.
- B. Equipment and Systems to Be Commissioned:
 - 1. New HVAC systems that were installed under this Contract.
 - 2. Existing HVAC systems that were modified, adjusted, upgraded, or affected by the work performed under this Contract.
- C. The following is a partial list of equipment that may be included in this HVAC Commissioning:
 - 1. Chillers.

2. Pumps.
3. Cooling tower.
4. Boilers.
5. Piping systems.
6. Ductwork.
7. Variable frequency drives.
8. Gas-fired heating ventilating units.
9. Gas-fired makeup air units.
10. Packaged roof top air conditioning units.
11. Split system air conditioning units.
12. Humidifiers.
13. Air handling units.
14. Air handling unit AHU duct system.
15. Packaged heat pump units.
16. Self-contained air conditioning units.
17. Packaged terminal air conditioning units.
18. Packaged terminal heat pump units.
19. Water source heat pumps.
20. Induction Units.
21. Unit Ventilators.
22. Fan Coil Units.
23. Electric terminal heating equipment.
24. Hot water terminal heating equipment.
25. Unit heaters.
26. Heat exchangers.
27. Computer room units.
28. Data room units.
29. Constant volume terminal units.
30. Variable volume terminal units.
31. Fans.
32. Variable volume changeover bypass system.
33. Fume hoods.
34. Laboratory room differential pressures.
35. Hospital room differential pressures.
36. Specialty fans.
37. Chemical treatment systems.
38. Fire dampers.
39. Smoke dampers.
40. Indoor air quality.
41. Equipment sound control.
42. Equipment vibration control.
43. Egress pressurization.
44. Smoke evacuation system.
45. Dust collection system.
46. Radiant floor heating system.
47. Kitchen hood supply systems.
48. Kitchen hood exhaust systems.
49. Automatic HVAC control system.
50. Testing, Adjusting and Balancing work.

1.5 COMMISSIONING SUBMITTALS

A. Draft Forms: Submit draft of system verification form and functional performance test checklist.

B. Test Reports: Indicate data on system verification form for each piece of equipment and system

as specified. Use AABC forms as guidelines.

- C. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 – Contract Closeout: Requirements for submittals.
- B. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.
- C. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC requirements.
- B. Maintain one copy of each document on site.

1.8 COMMISSIONING RESPONSIBILITIES

- A. Equipment or System Installer Commissioning Responsibilities:
 1. Attend commissioning meetings.
 2. Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
 3. Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
 4. Provide instructions and demonstrations for Owner's personnel.
 5. Ensure subcontractors perform assigned commissioning responsibilities.
 6. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
 7. Develop startup and initial checkout plan using manufacturer's startup procedures and functional performance checklists for equipment and systems to be commissioned.
 8. During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.
 9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
 10. Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
 11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
 12. Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.
 13. Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
 14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
 15. Perform verification checks and startup on equipment and systems as specified.
 16. Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
 17. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
 18. Conduct HVAC system orientation and inspection.

- B. Temperature Controls Installer Commissioning Responsibilities:
1. Attend commissioning meetings.
 2. Review design for ability of systems to be controlled including the following:
 - a. Confirm proper hardware requirements exist to perform functional performance testing.
 - b. Confirm proper safeties and interlocks are included in design.
 - c. Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
 - d. Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.
 - e. Confirm sensors selected are within device ranges.
 - f. Review sequences of operation and obtain clarification from Architect/Engineer.
 - g. Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.
 - h. Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers' stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.
 3. Inspect, check, and confirm proper operation and performance of control hardware and software provided in other HVAC sections.
 4. Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Architect/Engineer.
 5. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
 6. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan.
 7. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
 8. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
 9. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
 10. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.
- C. Testing, Adjusting, and Balancing Agency Commissioning Responsibilities:
1. Attend commissioning meetings.
 2. Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes. Repeat sample of 20 percent of measurements contained in testing, adjusting, and balancing report.
 3. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.9 COMMISSIONING MEETINGS

- A. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.10 SCHEDULING

- A. The General Contractor shall prepare schedule indicating anticipated start dates for the following:
1. Piping system pressure testing.
 2. Piping system flushing and cleaning.
 3. Ductwork cleaning.
 4. Ductwork pressure testing.
 5. Equipment and system startups.
 6. Automatic temperature control system checkout.
 7. Testing, adjusting, and balancing.
 8. HVAC system orientation and inspections.

9. Operation and maintenance manual submittals.
10. Training sessions.

- B. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.
- C. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.11 COORDINATION

- A. Notify Commissioning Authority minimum of two weeks in advance of the following:
 1. Scheduled equipment and system startups.
 2. Scheduled automatic temperature control system checkout.
 3. Scheduled start of testing, adjusting, and balancing work.
- B. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps required to meet performance requirements.
- B. Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.
- C. Install replacement sheaves and belts to obtain system performance, as requested by Commissioning Authority.
- D. Install test holes in ductwork and plenums as requested by Commissioning Authority for taking air measurements.
- E. Prior to start of functional performance test, install replacement filters in equipment as specified in individual section.

3.02 FIELD TESTS AND INSPECTIONS

- A. Seasonal Sensitive Functional Performance Tests:
 1. Test heating equipment at winter design temperatures.
 2. Test cooling equipment at summer design temperatures.
 3. Participate in testing delayed beyond Final Completion to test performance at peak seasonal conditions.
- B. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.
- C. Occupancy Sensitive Functional Performance Tests:
 1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.
 2. Participate in testing delayed beyond Final Completion to test performance with actual occupancy conditions.

END OF SECTION

SECTION 23 21 13 HYDRONIC PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

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.

- A. Piping to run approximately as shown on drawings or as structural and architectural conditions permit.

PART 2 – PRODUCTS

2.1 COPPER PIPES

- A. Type "L" hard-drawn seamless copper tubing, ASTM B-88:
 - 1. HVAC hot water piping 2-1/8" O.D. and smaller. Piping dimensions on drawings for piping 2-1/8" and smaller are outside diameter. (O.D.).
- B. Type "DWV" hard-drawn seamless copper tubing: Contractor's option for above-ground moisture condensate drain piping.
- C. Copper Pipe Fittings:
 - 1. Provide sweat fittings, ASTM B-62, dimensions conforming to ANSI B16.22, wrought copper, with sweep patterns for copper tubing.
 - 2. Dielectric connection: Provide Epco Sales, dielectric couplers at junction of steel pipe and equipment with copper piping systems. Use of steel or cast iron fittings in copper piping systems prohibited.
 - 3. Fittings for drainage piping to be drainage pattern type.
- D. Unions to be brass ground joint, 250-pound working pressure.
- E. Nipples used in conjunction with copper pipe to be brass.

2.2 VALVES

- A. Valves are specified by Nibco model numbers to establish quality levels unless otherwise noted. Milwaukee or Apollo are considered equal manufacturers. Provide clamp lock hand lever operators on valves less than 8 inches. Provide hand wheel and closed housing worm gear on valves 8 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.
- B. Gate Valves:
 - 1. Gate valves for 2-1/2" and larger steel piping systems to be Class 125, cast iron body, bronze mounted, flanged ends Nibco Model F617-O. Valves to have solid wedge disc, outside stem and yoke with rising stem, and bolted bonnet.
 - 2. Gate valves for 2" and smaller steel piping systems to be Class 125, bronze body, screwed ends, Nibco Model T111. Valve to have solid disc, rising stem, and union bonnet.
 - 3. Gate valves for copper piping systems to be Class 125, bronze body, solder ends, Nibco Model S111. Valve to have either solid or split wedge disc, inside screw, rising stem, and screwed bonnet.
- C. Globe Valves:
 - 1. Globe valves 2-1/2" and larger to be Class 125, cast iron body, bronze mounted,

- flanged ends, Nibco Model F718-B. Valves to have renewable seat and disc, outside stem and yoke with rising stem, and bolted bonnet.
2. Globe valves 2" and smaller to be Class 150, bronze body, screwed ends, Nibco Model T235Y. Valve to be plug type with renewable seat and disc, rising stem, and union bonnet.
- D. Ball Valves:
1. Ball valves for copper water piping systems 2-1/8" O.D. and smaller to be equal to Apollo "3" Figure 82-200, solder ends, and for 2-5/8" thru 3-1/8" O.D. to be equal to Apollo Figure 70-100, threaded ends. Valves to have bronze body, chromium plated bronze ball, teflon seats, stuffing box ring and seals, and quarter turn on-off. Provide memory stops for valves used for balancing service. Valves to be rated for 400-psi WOG at 200 degrees F. Install threaded end valves with brass adapters.
 2. Ball valves for PVC piping systems 2" and smaller to be equal to Celanese Piping System Chemtrol TU series, Schedule 80 PVC with teflon seats and vitron seals. Valves for pipe 3" and larger to be Celanese Piping System Chemtrol DE series, Schedule 80 PVC with teflon seats and vitron seals. Valves to be rated for 150 psi at 75 degrees F.
- E. Butterfly Valves:
1. Butterfly valves for steel water piping systems to be Crane Monarch Figure 24N, Centerline Series LT, or approved equal industrial quality lug type with threaded holes. Valves to provide bubble-tight shut-off at 150 psi working pressure and 200 degrees F. Valves to have ductile iron body, "EPT" seats and stem seals, 316 stainless steel or bronze disc, 316 or 416 stainless steel stems. Valves 4" and larger to have weatherproofed sealed gear operator consisting of fully enclosed worm, worm gear, and worm shaft with handwheel to provide necessary torque for close-off and infinite throttling positions. Valves 3" 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.
- F. Check Valves:
1. Check valves for copper water piping systems to be swing type, Class 125, bronze body, screwed ends, Nibco Model T/S413.

2.3 STRAINERS

- A. Provide cleanable "Y" type strainers in pump suction lines. Strainers to have iron body with screwed bronze or bolted iron cap. Strainer baskets to be brass. Water strainers to be Monel 20 mesh screen. Strainers to be line size complete with blow-down hose bibbs. When Suction Diffusers are specified for end suction pumps, strainers are not required. Strainers to be as follows:
1. Screwed 125# - Crane 988-1/2.
 2. Flanged 125# - Crane 989-1/2.
 3. Solder joint 250# - Muessco 353-1/2.

2.4 HANGERS

- A. Insulated steel piping 1/2" thru 24", galvanized piping 1/2" thru 24", copper piping 1/2" O.D. thru 4" O.D., with no longitudinal movement to be Grinnell Figure 260, MSS SP-69 Type 1, adjustable clevis hanger with Figure 167, MSS SP-69 TYPE 40, galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation.
- B. Non-insulated cast iron soil pipe thru 8" to be Grinnell Figure 104, MSS SP-69 TYPE 6, adjustable swivel ring, split ring type, and pipe 10" thru 15" Grinnell Figure 260,

- MSS SP-69 TYPE 1, adjustable clevis hanger.
- C. Non-insulated copper tubing 1/2" O.D. thru 4" O.D. with no longitudinal movement to be Grinnell Figure CT-99C, MSS SP-69 TYPE 9, plastic coated adjustable tubing ring hanger.
 - D. Insulated steel piping 1" thru 30" with longitudinal movement to be Grinnell Figure 171, MSS SP-69 TYPE 41, pipe roll complete with Figure 160, MSS SP-69 TYPE 39A or 39B, pipe insulation protection saddle sized for proper pipe size and insulation thickness.
 - E. Insulated copper piping 1/2" O.D. thru 2-1/8" O.D. with longitudinal movement to be Grinnell Figure 171, MSS SP-69 TYPE 41, pipe roll complete with Figure 167, MSS SP-69 TYPE 40, galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation.
 - F. Support copper pipe risers by Grinnell Figure CT-121C, MSS SP-69 TYPE 8, plastic coated riser clamps at floor penetrations.
 - G. Support steel pipe risers by Grinnell Figure 261, MSS SP-69 TYPE 8, riser clamps at floor slab penetrations.
 - H. Support three or more parallel lines by trapeze hangers utilizing Unistrut channel or equal in bottom mounting arrangement with rod hanging support.
 - I. Adequately size hangers on insulated piping for insulation to pass continuously through hangers. Insulated piping to be supported outside insulation covering.
 - J. Provide concrete inserts, Grinnell Figure 282, MSS SP-69 TYPE 18, universal concrete insert, for attaching hangers to building structure. Inserts to be adequately sized and correctly positioned to support piping, valves, etc., when full of water and system is in operation.
 - K. Support all piping by heavy steel, adjustable hangers, or brackets suitably fastened to structural portion of building. Place hangers in accordance with following tables:

COPPER TUBING SUPPORTS	
SIZE (IN.)	DISTANCE BETWEEN SUPPORTS (FT.)
5/8	6
7/8 - 1-1/8	8
1-3/8 - 2-1/8	10
2-5/8 - 5-1/8	12
6-1/8 - 8-1/8	14

- L. Perforated metal, strap iron, or band iron hangers are not permitted. Offsets in hangers are not allowed. Pipe risers to be supported at regular intervals in pipe shafts within the limits of good practice.
- M. See Insulation Section for requirements at pipe hangers.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install piping not to interfere with opening of doors or other moving parts. Do not install

- piping near or directly over any portion of electrical equipment.
- B. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in finished spaces. Mechanical rooms and janitor closets are not considered "finished" spaces.
 - C. Hang piping so equipment, flanges, and connections do not bear weight of piping.
 - D. Adequately support vertical lines at their bases or by a suitable hanger placed in horizontal line near riser or by a base fitting set on pedestal.
 - E. 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.
 - F. Run piping in straight lines; riser lines to be plumb with such offsets only as indicated or necessary. No sagging of lines permitted.
 - G. Unless otherwise shown on drawings, lines to be installed to drain to sumps or sewer.
 - H. 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.
 - I. 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.
 - J. 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.
 - K. Piping to have sufficient number of flanges or unions for convenient installation and removal of piping and equipment.
 - L. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
 - M. Install piping to prevent stresses and strains to piping and hangers from expansion or contraction. Provision for proper loops, offsets, or expansion joints to be responsibility of Contractor. Make provision for servicing and removal of equipment without dismantling piping.

3.2 FIRE-RATED PARTITIONS

- A. Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. Review details on drawing as well as this specification for permissible firestop systems. 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.

3.3 NON-RATED PARTITIONS

- A. 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.

3.4 PIPE SLEEVES

- A. Pipe sleeves shall be provided at non-rated partitions and floor penetrations. Pipe sleeves to be Schedule 40 or 18 gage 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.
 - 1. Piping requiring sleeves:
 - a. Chilled water

3.5 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS

- A. Refer to drawings. No water piping permitted in transformer, electrical, or elevator equipment rooms.

3.6 VALVE ACCESS

- A. Locate all shutoff and control valves for easy access and operation. Where valves must necessarily be located in enclosed spaces, they shall be provided with access panels of sufficient size for operation. Furnish these access panels to proper trades for installation.

3.7 AIR VENTING

- A. Provide manual air vents at high points of vertical risers and at each water coil to eliminate air from HVAC water systems.

3.8 WATER DRAINING

- A. Provide 3/4" hose end gate valves at low points and bottom of each riser to drain HVAC water systems.

END OF SECTION 23 21 13

SECTION 23 21 16 HYDRONIC PIPING SPECIALTIES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Compression tank.
- B. Tangential air separator.
- C. P.T. test plugs.
- D. Pressure gauges.
- E. Digital thermometers.
- F. Thermometer test wells.
- G. Relief valves.
- H. Flow balancing valve.
- I. Flow measuring meter.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bell and Gossett ITT, Dieterich Standard, Flow Design, Gerand, Mueller, Peterson Engineering, Taco, Thrush, John Wood Industrial Products, Weiss Instruments, Inc.

2.2 EQUIPMENT

- A. Compression Tank:
 - 1. Tanks to be pre-charged diaphragm type 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 240 degrees F.
 - 3. Unit shall be stamped with ASME "U" symbol.
 - 4. Diaphragm to be replaceable heavy-duty butyl rubber.
 - 5. Tank to have system connection, drain connection, and charging valve connection.
 - 6. Provide tanks with mounting saddles for horizontal installations and floor mounting base for vertical installations.
- B. 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.

8. Unit to prevent accumulation of air in hydraulic heating and/or cooling system and prevent noises caused by entrained air in piping.
 9. Separator to be Bell & Gossett ITT Rolairtrol, or approved equal.
- C. P.T. Test Plugs:
1. Provide 1/4 inch solid brass pressure/temperature test plugs at each BAS temperature sensor and at the entering and leaving connections of coils, chillers, hot water boilers, and heat exchangers.
 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.
- D. Pressure Gauges:
1. Provide 3-1/2 inch dial, glycerin-filled pressure gauges across chillers (cooler and condenser), pumps, and AHU coils.
 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.
- E. Digital Thermometers:
1. Provide solar digital vari-angle Weiss Instruments, Inc., Model DVU-35 (no substitutions) with adjustable angle (rear, front, and side) thermometers across chiller coolers and condensers, entering and leaving heat exchanges hot water boilers and AHU coils.
 2. Each thermometer to be self-powered and within 1% accuracy. Stem assembly to be industrial glass.
- F. 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.
- G. 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.
 6. Set differential between opening and closing pressure to prevent water flash and water hammer.
 7. Valve to include manual lever for testing valve.
- H. Flow Balancing Valve:
1. Balancing/shut-off valve to be ball type with bronze/brass body, 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 1/2" 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 Accusetter or approved equal Venturi type.
- I. Flow Measuring Meter:
 - 1. Provide portable flow measuring meter capable of indicating pressure differential across previously specified flow balancing valves and flow measuring stations.
 - 2. Unit to be complete with hoses, shutoff and vent valves, and carrying case.
 - 3. Flow measuring meter to be made by manufacturer of associated flow balancing/measuring devices.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install hydronic specialties in strict accordance with manufacturers' published installation instructions.
- B. Provide 1/2" manual air vents at top of pipe risers and other locations where air can be trapped or collected.
- 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 23 21 16

SECTION 23 21 23 - HVAC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Base mounted pumps.
- B. In-Line circulators.

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC Systems.

1.3 SUBMITTALS

- A. Submit under provisions of Section 23 05 00. Where unit is specified to be packaged with equipment, submittals shall accompany the chiller submittal.
- B. Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- C. Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years experience.
- B. Alignment: Base mounted pumps shall be aligned by qualified millwright and alignment certified.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 23 05 00.
- B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site; store and protect product as recommended by manufacturer.

1.7 EXTRA PARTS

- A. Provide one extra set of mechanical seals for each pump.

PART 2 PRODUCTS

2.1 GENERAL CONSTRUCTION REQUIREMENTS

- A. Balance: Rotating parts, statically and dynamically.
- B. Construction: To permit servicing without breaking piping or motor connections.
- C. Pump Motors: Operate at 1750 rpm unless specified otherwise.
- D. Pump Connections: Flanged.

2.2 BASE MOUNTED PUMPS

- A. Pumps shall be base mounted, single stage, end suction design with a foot mounted volute to allow servicing of the impeller and bearing assembly without disturbing piping connections.
- B. Pump volute shall be cast iron with integrally-cast pedestal support feet. The impeller shall be cast bronze enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew.
- C. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225 degrees F. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.
- D. Pump shall be rated for minimum of 175 psi working pressure. Volute shall have gauge tapings at the suction and discharge nozzles and vent and drain tapings at the top and bottom.
- E. Base plate shall be of structural steel or fabricated steel channel with fully enclosed sides and ends, and securely welded cross members. Grouting area shall be fully opened. A flexible type, center drop-out design coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor. Coupler shall be shielded by a coupler guard securely fastened to the base. The pump shall have a drip pan with drain connection.
- F. Motor shall meet NEMA specifications and shall be of the size, voltage and enclosure called for on the plans. Pump and motor shall be factory aligned, and shall be realigned by contractor after installation.
- G. Each pump shall be factory tested per Hydraulic Institute Standards and meet the capacities indicated. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

2.3 IN-LINE CIRCULATORS

- A. Pumps shall be in-line type, closed coupled, single stage design, for installation in vertical or horizontal position, capable of being serviced without disturbing piping connections.
- B. Pump volute shall be of Class 30 cast iron. The impeller shall be non-ferrous, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew.
- C. The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225 degrees F. A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.
- D. Pump shall be rated for minimum of 175 psi working pressure. Volute shall have gauge tapings at the suction and discharge nozzles and vent and drain tapings at the top and bottom.
- E. Motor shall meet NEMA specifications and shall be of the size, voltage and enclosure called for on the plans. It shall have heavy duty grease lubricated ball bearings, completely adequate for the maximum load for which the motor is designed.
- F. Each pump shall be factory tested per Hydraulic Institute Standards. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install pumps in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate above efficiency indicated.
- D. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
- E. Provide line sized shut-off valve and suction diffuser on pump suction, and line sized combination pump discharge valve on pump discharge.
- F. Provide air cock and drain connection on horizontal pump casings.
- G. Provide drains for bases and seals, piped to and discharging into floor drains.

- H. Lubricate pumps before start-up.
- I. Install base mounted pumps on concrete base, with anchor bolts, set and level, and grout in place.
- J. Qualified millwright shall check, align, and certify base mounted pumps prior to start-up.

END OF SECTION

SECTION 23 25 13 WATER TREATMENT FOR CLOSED HYDRONIC SYSTEMS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide a complete water treatment system for the closed hot water systems as specified herein. Provide system start-up and adjustment.
- B. Provide one years supply of water treatment chemicals and systems pre-cleaning chemicals.
- C. Submit complete water treatment systems for approval.
- D. All hot water piping and related equipment shall be thoroughly flushed out with pre-cleaning chemicals designed to remove deposition such as pipe dope, oils, loose rust, mill scale and other extraneous materials. Recommended dosages of pre-cleaner chemical products shall be furnished by water treatment supplier and added and circulated throughout the water systems. The water systems shall then be drained, refilled and flushed thoroughly until no foreign matter is observed and total alkalinity of the rinse water is equal to that of the make-up water.

PART 2 – PRODUCTS

2.1 CLOSED HOT WATER TREATMENT SYSTEMS

- A. Provide a one-shot chemical feeder of 5-gallon capacity and minimum 125 PSI working pressure for each closed water system. Feeder to be complete with funnel with fill valve, and inlet, outlet and drain connections.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and place complete water treatment systems in proper operating condition in accordance with drawings, specifications, and manufacturer's published installation instructions. Provide communication link between water treatment microprocessor and Building Automation System PC.
- B. Permanent facility pumps should not be used for circulating the cleaning water. However if it is impractical to use temporary pumps, the permanent facility pump may be used provided that the pump is unconditionally warranted for two years, parts and labor, after the date of substantial completion by the mechanical contractor.
- C. Water treatment equipment manufacturers' representative to supervise systems pre-cleaning, water treatment systems installation and start-up, and train owners' representatives a minimum of 8 hours concerning proper feeding and control techniques. Provide two copies of water treatment systems operating and maintenance manuals to Designer.
- D. Cleanness of the system shall be determined by water sampling performed by the water management chemical engineer and witnessed and approved in writing by the General Contractor's quality control representative.

END OF SECTION 23 25 13

SECTION 23 31 10 SHEET METAL DUCTWORK - LOW PRESSURE

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 have 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.
- C. Low pressure ductwork shall be constructed to meet the following pressure class:
 - 1. Supply ductwork downstream of terminal units: 1.0" pressure class.
 - 2. Supply and return duct connections to fan coil units or single zone air systems (ESP \leq 1.0"): 1.0" pressure class.
 - 3. Supply and return duct connections to fan coil units or single zone air systems (ESP >1.0", \leq 2.0"): 2.0" pressure class.
 - 4. Exhaust and return ductwork (Fan ESP \leq 2.0"): 2.0" pressure class.
 - 5. Return duct within 100 feet of a fan: 3.0" pressure class.

1.2 QUALITY CONTROL AND REGULATORY STANDARDS

- A. SMACNA Manual: Sheet Metal Tradesman is to have access on the construction site to the Latest Edition of SMACNA "HVAC Duct Construction Standards", (Metal and Flexible). The Manual is referred to in specifications for required construction methods and details. Contractor shall comply with provisions of the SMACNA Manual and more stringent requirements of this specification.
- B. 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).
- C. Provide galvanized duct materials which meet applicable requirements of SMACNA manual and local and state codes, whichever is the most stringent.
- D. Support ductwork in accordance with applicable requirements of SMACNA manual, local and state codes, and details on plans, whichever is the most stringent.
- E. Emboss fittings with material gauge, manufacturer, and type material.
- F. Materials used as sealers, liners, pre-insulated jackets and flexible ducts shall comply with a flame spread rating of 25 or less and a smoke developed rating of not over 50.
- G. Joint sealer shall meet the requirements of UL181A or UL181B as applicable.
- H. Duct sealant classification: Seal all transverse joints, longitudinal joints and duct wall penetrations in accordance with SMACNA Class A. The sealant used to seal the longitudinal joints of low pressure ductwork must be visible or the joints shall require resealing in the field.

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. Shop Drawings: Contractor to submit to owner for approval complete sheet metal shop drawings of all ductwork, including equipment rooms, shafts, and especially congested areas and areas with possible conflicts. No installation shall proceed without owner stamped approval of shop drawings. Submittal to reflect space requirements coordinated with other trades such as Electrical, Plumbing, Mechanical and Structural. Prior to submission to owner, shop drawings to have stamped approval of all major trades which occupy ceiling space (HVAC, plumbing, piping, sprinkler, and electrical), to substantiate adequate coordination as to space, accessibility and to ensure no conflict exists between contractors.
- C. The General Contractor shall be responsible for coordination between trades and shall stamp and sign the duct drawings to substantiate that the coordination has been accomplished. 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: Hardcast Iron Grip 601 or equal, Single Stage Sealant Process.

2.2 FABRICATION

- A. Provide a rectangular or round duct where required on drawings of prime quality galvanized steel sheets, thickness and reinforcement as required by latest edition of 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. Ductwork to be no lighter than 24 gauge. Contractor may substitute heavier gauge at no additional cost.
- B. Duct dimensions shown on drawings indicate inside clear dimensions.

- C. In addition to the requirements above, add supplemental bracing as necessary to prevent sagging, drumming, and vibration.
- D. Round prefabricated slip joint duct may be used on exhaust and return duct 12" and smaller and for runout duct to boxes, diffusers, registers, and grilles.
 - 1. Secure duct sections and fittings with sheet metal screws.
 - 2. Make connections of round duct to rectangular duct using "spin-in" collars with manual volume damper.
 - 3. Transverse and longitudinal slip joints shall be sealed with approved sealer.
- E. Provide transverse joints of "s" and drive construction at least every eight feet on duct whose larger side is less than 18". Seal all transverse joints with joint sealant material.
- F. Provide transverse joints, or equivalent supplemental angle reinforcing on 4 foot centers on duct whose larger side is greater than 18". At the contractor's option, duct mate or equal joint system may be substituted for "s" and drive construction. Seal all transverse joints with joint sealant material.
- G. Longitudinal seams shall be Pittsburg Lock or grooved seams closed tightly and evenly. Button punch snap lock longitudinal seam construction shall not be allowed. Seal longitudinal joints which prove to leak with joint sealant material.
- H. Cross break ductwork over 10" dimension, either side.
- I. Do not exceed 20 degree angle of slope for increase-in-area transitions.
- J. Do not exceed 20 degree angle of slope for decrease-in-area transitions.
- K. Do not exceed 30 degrees on the entering side or 45 degrees on the leaving side for angle of transitions at connections to equipment without the use of approved vanes. 20 degree angle is preferred and should be used space permitting.
- L. Provide Ells fabricated to one of the following specifications in order of preference (SMACNA Figures 4-2 through 4-4 and Figure 4-9 and Chart 4-1):
 - 1. Unvaned elbow with the throat radius equal to 3/4 of the width of the duct and with a full heel radius.
 - 2. Six inch throat radius with full radius, single thickness vanes and full heel radius. Maximum unsupported length of vanes shall be 36". Vanes shall be securely fastened to runners. All vanes shall be secure and stable in installed operating position. Construct vane edges to project tangents parallel to duct sides.
 - 3. Square elbows with single thickness turning vanes. Maximum unsupported length of vanes shall be 36". Vanes shall be securely fastened to runners. All vanes shall be secure and stable in installed operating position. Construct vane edges to project tangents parallel to duct sides.
 - 4. Radius elbows are the preferred fitting. Square elbows are to be used only when available space prevents the use of radius elbows.
- M. Provide offsets as necessary in accordance with SMACNA Figure 4-7.
- N. Make branch connections and tees in one of the following manners:
 - 1. Converging radius elbow with MVD. (SMACNA Figure 4-5).
 - 2. 45-degree entry with MVD. (SMACNA Figure 4-6).
 - 3. Round spin-in fitting with MVD.
- O. Space duct joints to avoid cutting them for branch take offs and outlet collars.

PART 3 EXECUTION

3.1 INSTALLATION, APPLICATION, ERECTION

- A. Support ductwork on each side of the duct with suitable sheared strips of galvanized metal or 1" x 1/8" galvanized steel band iron hangers.
- B. Attach hangers to the ductwork using sheet metal screws.
- C. Secure hangers to concrete structure with approved anchor shields and to steel structure by means of C-clamps.
- D. Space hangers approximately eight feet along the duct except as noted below.
- E. For ducts 60" and larger and heavy sections, such as welded duct and sound absorbers, space hangers at approximately four foot intervals.
- F. Obstructions shall not be located within ducts.
- G. Do not exceed 45 degrees for easement transition angle.
- H. All ductwork, including supply, return and exhaust shall have circumferential joints, longitudinal joints, and duct wall penetrations externally sealed in accordance to SMACNA Class A. The sealant used to seal the longitudinal joints of low pressure ductwork must be visible or the joints shall require resealing in the field.
- I. 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. Metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished to be mounted on duct.
- J. Counterflashing: Counterflash all ducts where they pierce the roof.
- K. Pitot Ports: Pitot ports for measuring airflow to be located in each main duct at the downstream end of the straightest run of the main and before the first branch take-off. Pitot ports to be formed by drilling 7/16" holes in the duct, lined up perpendicular to airflow on maximum 8" centers and at least three to a duct, evenly spaced. Holes to be plugged with plastic plugs. Provide access to these for future rebalancing.

3.2 CLEANING

- L. Clean ductwork thoroughly to assure all foreign matter, dirt, etc. is removed.

END OF SECTION 23 31 10

SECTION 23 33 00 AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Specialties to be submitted and approved before starting installation.
- B. Items to be installed approximately as shown on drawings taking into account differences in mechanical equipment submitted and that shown on contract documents. Each item to be installed so that it is readily accessible for maintenance, repair, and/or setting and balancing.
- C. Diffusers, registers, and grilles to have ratings certified by Air Diffusion Council and tested per ADC Equipment Test Code 1062R2 and ASHRAE Standard 36B-63.
- D. Refer to drawings for diffuser, register, and grille sizes and number of airflow directions.

PART 2 – PRODUCTS

2.1 FIRE DAMPERS

- A. Fire dampers to be U.L. listed in accordance with UL-555. Fire dampers to be held in an open position with a 165 degree F fusible link and arranged to lock in position on closure.
- B. Fire dampers for rectangular duct to be type "B" and for round duct to be Type "C". Fire dampers located behind sidewall registers and grilles and others specifically indicated on drawings to be Type "A". Fire dampers to be multi-leaf type with spring closing for horizontal mounting and weighted-gravity closing for vertical mounting. Dampers to be steel construction with rust resistant finish and provided with a factory-installed mounting sleeve suitable for structure. Mount per manufacturer's published U.L. approved installation instructions.
- C. See Architectural drawings for hour-rating of walls and/or floors. Dampers to be compatible with hour ratings.

2.2 COMBINATION SMOKE/FIRE DAMPERS

- A. Combination smoke/fire dampers to be U.L. listed both as 1-1/2 hour fire damper under UL-555 and as smoke damper under UL-555S as Minimum Leakage Category II and Elevated Temperature Category B (350 degrees F).
- B. Dampers to be steel construction with rust resistant finish and provided with 165 degree F fusible link and factory-installed mounting sleeve suitable for structure. Mount damper per manufacturer's published U.L. approved installation instructions.
- C. Damper operator to be electric type compatible with electrical characteristics used for smoke detection and/or fire alarm system.
- D. Dampers to be Ruskin Model FSD35 with crimped type blades for low-pressure duct systems and Ruskin Model FSD60 with airfoil blades for medium and high-pressure duct systems.

2.3 DAMPERS

- A. Automatic Control Dampers: All automatic control dampers to be furnished by Control Subcontractor and installed by this Contractor (except unit mounted dampers).
1. Automatic control dampers to be low-leak, galvanized steel or aluminum construction parallel blade type, Ruskin Model CD36, Arrow Series 395, or approved equal.
 2. Dampers to be complete with minimum 4" deep, 16-gauge hat-shaped channel frame, minimum 16 gauge blades on maximum 6" centers, 1/2" diameter shafts, and corrosion resistant bearings.
 3. Dampers to have extruded vinyl blade seals and stainless steel or aluminum flexible metal compression type jamb seals to limit leakage to a maximum of 1/2% (maximum of 5.4 cfm/sq. ft. leakage for 48" x 48" size damper) when tested in accordance with AMCA Standard 500.
 4. Motor actuator to be oil immersed gear train, 120-volt line voltage type with spring return to closed position on power interruption. Provide Honeywell Model M445/845, Barber- Colman MA-5210/5330 or approved equal complete with damper linkages.
- B. Manual Volume Dampers (MVD): Manual volume dampers to be hand-operated type dampers constructed of galvanized steel, minimum 22-gauge for duct widths 18" and less, minimum 16- gauge for duct widths greater than 18". Dampers for ducts to 12" height and 12" diameter to be single blade carried on a 3/8" round steel rod mounted inside of duct without frame and fitted with locking type quadrant and brass end bearing plate accurately drilled and secured to duct. Dampers for ducts greater than 12" height to be multi-blade type, 12" maximum blade width up to 30" blade length and 10" maximum blade width over 30" blade length. Blades to be mounted on frame with brass sleeve bearings interconnected for operation from one locking type hand quadrant. Round pivot rods to have section faced flat to receive locking setscrew in locking quadrant. Refer to SMACNA manual Figures 2-14 and 2-15.
1. For manual damper locations above a rigid or non-accessible ceiling or where damper access is limited, a remote damper operator shall be used. Damper operator to be self- locking worm gear designed for 3/8" damper shaft. Shaft extension to be 3/8" square rod with coupler. Remote operator to be provided with wrench operated shaft adjustment, position indication and lock nut. Where straight shaft extension cannot be used due to accessibility, a flexible cable operator with compatible damper operator and regulator may be utilized. Damper operator, shaft and regulator shall be designed for minimum 35 in-lb torque. Remote operator in non-sterile areas to be ceiling mounted with removable cover plate or mounted above access door. Sterile area installations such as surgery rooms or elsewhere as indicated on drawings shall use bracket mount installation above access door. Where multiple operators are routed to single or multiple access locations, provide markings to identify the associated air device for future use. The damper operator, shaft extension and ceiling termination/regulator shall be manufactured by Young Regulator, Inc. or approved equal.
 2. Ductwork manual volume damper (MVD) handles in externally wrapped ductwork shall be supplied with a stand-off bracket and locking quadrant to ensure that the handle can be adjusted without disturbing the insulation vapor barrier.
- C. Backdraft Dampers (BDD): Backdraft dampers to be Ruskin Model CBD6 or approved equal low-leak counterbalanced backdraft dampers. Dampers to be heavy-duty type suitable for air velocities to 2500 fpm with all extruded aluminum construction, minimum 0.81" thick frame, and minimum .050" thick blades on maximum 4" centers. Provide blades with vinyl edge seals. Provide dampers with aluminum linkage and corrosion resistant type bearings. Provide dampers with adjustable counterbalances

on blades to assist closing.

2.4 SQUARE CEILING DIFFUSERS

- A. Provide Titus TDC or approved equal round or square neck, louvered face ceiling diffusers at all locations designated by schedule on drawings. Diffusers to be all steel construction. Frame to be flush mount for diffusers in "hard" ceilings and lay-in T-bar mount for diffusers in lay-in ceilings. Finish to be baked-on, off-white enamel.

2.5 SQUARE CEILING DIFFUSERS

- A. Provide Titus Omni or approved equal round neck, square steel panel face ceiling diffusers at all locations designated by schedule on drawings. Diffusers to be steel or aluminum construction. Frame to be flush mount for diffusers in "hard" ceilings and lay-in T-bar mount for diffusers in lay-in ceilings. Finish to be baked-on, off-white enamel.

2.6 LINEAR BAR DIFFUSERS

- A. Provide Titus CT-540 or approved equal linear bar diffuser at all locations designated by "LSD" on drawings. Linear bar diffuser to be extruded aluminum construction with 0 degree deflection, 1/4" wide fixed bars spaced 1/2" apart. Diffuser to be complete with maximum 3/4" flanged border, and concealed fastening. Finish to be baked-on, off-white enamel.

2.7 LAMINAR FLOW DIFFUSERS

- A. Provide Titus "TLF" or approved equal laminar flow, steel, perforated face ceiling diffuser at all locations designated by schedule on drawings. Diffuser to have round neck, balancing deflector ring, 3/32" diameter holes on 1/4" centers in a 60 degree staggered pattern, retainer cable and suitable for either surface-mounted or laid-in T-bar ceiling system. Finish to be baked-on, off-white enamel.

2.8 SIDEWALL RETURN REGISTERS

- A. Provide Titus 33-RL heavy duty registers at all locations designated on drawings. Registers to be minimum 16-gauge steel construction complete with minimum 38 degree deflection fixed blades spaced 1/2". Finish to be baked-on, off-white enamel.

2.9 CEILING RETURN & EXHAUST REGISTERS

- A. Provide Titus Model 50-F or approved equal at locations designated by schedule on drawings. Registers to be complete with 1/2" cube egg-crate aluminum grid. Finish to be baked-on, off-white enamel. Border to be flush mounted frame style.

2.10 AIR LOUVERS

- A. Stationary air louvers to be extruded aluminum construction, fixed drainable blade type, Miami- Dade Qualified, Greenheck Model ESD-635D (N.O.A. # 17-0919, Exp. 12/6/22) or approved equal. Louvers to be constructed of minimum 0.081" thick frame and blades. Louver depth to be 6" with equal blade spacings. Blade construction to provide built-in rainstops. Finish shall be Kynar 70% PVDF paint finish with color selected by Architect. Manufacturer will submit metal color chip to Architect as part of

the submittal approval. Louver shall be rated at: 1,250 fpm beginning water penetration (at maximum 0.1 oz. per square foot), minimum 55% free area, 0.15" S.P. resistance at 1,000 fpm. Provide 1/2" mesh expanded aluminum screen with removable frame mounted on inside face of louver. Provide minimum 10 year finish warranty.

2.11 FLEXIBLE CONNECTORS

- A. Install UL listed flexible duct connectors between duct and fan/equipment connections. Flexible duct connectors to be made of 28-ounce, heavy glass fabric double coated with neoprene.

2.12 FLEXIBLE DUCT

- A. Flexmaster Type 1M Acoustical Attenuating or Approved equal. Submit acoustical performance of any alternate product for prior approval.
 - 1. Characteristics of flexible duct:
 - a. Approved as UL-181 Class 1 air duct.
 - b. Flame spread rating less than 25 and smoke developed rating less than 50.
 - c. Rated for 6" w.g. positive pressure, 4" w.g. negative pressure, and 5000 fpm air velocity.
 - d. Tear and puncture resistant reinforced CPE inner liner mechanically locked together with a corrosive resistant galvanized steel helix.
 - e. Insulated with minimum 1/2" thick fiberglass insulation with vapor barrier jacket.
- B. Seal off the insulation jacket at its ends and at joints with mastic, Hardcast, or similar material. Replace flexible duct if jacket is punctured.
- 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 6 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 and only one bend may occur per 6 foot length of duct material.

2.13 DUCT ACCESS DOORS

- A. Duct access doors to be provided for access to all coils, fire, fire/smoke, and smoke dampers, automatic and backdraft dampers, duct smoke detectors, static pressure and air volume sensing devices, and other equipment installed in ducts and at other points indicated on drawings.
- B. Access door construction and airtightness must be suitable for the duct pressure class used (low, medium, or high).
- C. Access doors to be double-panel, galvanized steel construction with minimum 1" rigid insulation between panels. Access doors in exhaust duct and unlined return duct may be uninsulated single panel, galvanized steel construction. Doors to mount in rigid frame constructed of formed galvanized steel. Angle iron bracing to be used as required to provide rigid assembly. Doors to hinge on one side with door latch on opposite side.
- D. Access doors in ductwork shall fully comply with Figure 2-12 and 2-13 of SMACNA manual. Casing access doors shall fully comply with Figure 6-11 and 6-12 of SMACNA manual.
- E. Doors to close against gasket seal.

- F. Ductwork and/or equipment access doors shall be required at all motorized dampers, fire/smoke dampers, smoke detectors, airflow monitoring stations, duct-mounted temperature/pressure sensors and/or transmitters, vaned elbows, duct-mounted heat transfer coils, sound attenuators and any other mechanical and/or control device requiring inspection, maintenance or test access. In addition, 24" x 24" access doors should be utilized wherever possible to facilitate adequate access for maintenance and/or testing.
- G. Access doors for fire dampers, fire/smoke dampers, and smoke dampers shall be permanently identified on the exterior by a label having letters not less than 0.5 inches in height reading: "Fire Damper" "Fire/Smoke Damper" or "Smoke Damper" as required by 2012 International Mechanical Code.

2.14 DUCT MOUNTED SMOKE DETECTOR

- A. Duct mounted smoke detectors shall be furnished by Division 26. Coordinate power and control wiring. Installation of smoke detector shall by Division 23.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Installation to be in accordance with manufacturers' published installation instructions as well as applicable sections of SMACNA manual.
- B. Provide all screws, bolts, nuts, and inserts required for attaching sheet metal specialty items to ducts, walls, floors and ceilings.

END OF SECTION 23 33 00

SECTION 23 34 00 CENTRIFUGAL FANS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. This section includes requirements for all centrifugal fans. Refer to drawings and schedules for style of fan and accessories to be provided.
- B. Provide fan type, capacity, direction of rotation, discharge direction, and arrangement as shown on drawings.

1.2 PERFORMANCE

- A. Certify fan performance in accordance with AMCA Certified Air and Sound Rating Criteria Standard 210, 300, and 301.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. ACME, Greenheck, Barry Blower, Twin City, Cook, or approved equal.

2.2 CENTRIFUGAL EXHAUST FANS

- A. Non-overloading, backward inclined, aluminum centrifugal fan wheel.
- B. Variable pitch V-belt drive or direct drive as scheduled.
- C. Roof or wall mounting as scheduled.
- D. Removable heavy gauge aluminum fan housing enclosing motor outside airstream.
- E. Permanently lubricated, ball bearing fan motor.
- F. Isolate fan motor, wheel, and drive from base with rubber vibration isolators.
- G. Electrical junction box.
- H. Gravity backdraft damper.
- I. Birdscreen around fan discharge.
- J. Disconnect switch on single-phase fans.
- K. Prefabricated, 1" thick fiberglass insulated, minimum 18-gauge aluminum or galvanized steel construction, minimum 12" high roof curb. Coordinate required curb base type with roof construction, pitch, and flashing requirements. See architectural drawings.
- L. Upblast housing when scheduled on drawings.
- M. Solid state variable speed controller when scheduled on drawings.
- N. Sparkproof construction with explosionproof motor when scheduled on drawings.
- O. See fan schedule on drawings for other required accessories.

2.3 BELTED VENT SETS

- A. Belted vent sets shall be a completely packaged unit including fan assembly, motor, adjustable belt drive, and adjustable motor base.
- B. Wheels and Housings: Wheel diameters and discharge areas shall be sized in accordance with AMCA Standards.
- C. Housing Construction: Heavy gage continuously welded steel. Housings shall be suitably braced to prevent vibration and pulsation. Housings shall be field rotatable to different discharge positions. Inlets shall be fully streamlined. Provide inlet and discharge flanges.
- D. Painting: Factory applied, corrosion-resistant paint.
- E. Shaft: Solid hot rolled steel, ground accurately for a smooth bearing fit.
- F. Provide heavy duty, anti-friction, self-aligning ball or roller type bearings. Position bearing supports to directly oppose drive belt tensions and transmit loads to the fan base. Bearings to have a minimum L10 life of 40,000 hours.
- G. Mount motor on an adjustable slide rail base.
- H. Provide steel fan base.
- I. Motor horsepowers and outlet velocities shall not exceed that scheduled on drawings.
- J. Fans shall be statically and dynamically balanced at the factory.
- K. Provide fans with OSHA approved expanded metal beltguards with tach hole for checking fan shaft speed.
- L. Provide fans which all use same type grease.
- M. Provide fan housing drain.
- N. Provide housing access door.
- O. Fans for outdoor mounting to be completely weatherproofed, with a fan motor and drive weather cover, and complete epoxy coating.
- P. Exhaust fans serving airborne infection isolation (All), emergency department waiting rooms, and decontamination rooms shall discharge a minimum of 10'-0" above the finished roof. Refer to details on the drawings.

2.4 SQUARE CENTRIFUGAL IN-LINE FANS

- A. Non-overloading, backward inclined, aluminum centrifugal fan wheel.
- B. Variable pitch V-belt drive or direct drive as scheduled.
- C. Heavy gauge aluminum or galvanized steel housing with duct connection at fan inlet and outlet and removable access panels to access all interior components without removing ductwork or wiring.
- D. Permanently lubricated, ball bearing fan motor.
- E. Electrical junction box.
- F. Gravity backdraft damper.
- G. Disconnect switch on single-phase fans.
- H. Belt guard/motor cover.
- I. Internally insulated housing when scheduled on drawings.
- J. Solid state variable speed controller when scheduled on drawings.
- K. Rubber vibration isolators when scheduled on drawings.

- L. Epoxy coating when scheduled on drawings.
- M. See fan schedule on drawings for other required accessories.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install fans in locations shown on drawings in accordance with manufacturers' published installation instructions.
- B. Connect fans to ductwork by means of flexible connections.

3.2 TEST AND ACCEPTANCE

- A. Start-up and checkout fan for proper motor phasing, alignment, and vibration free operation. Correct improperly aligned fans. Change unmatched belts.
- B. Demonstrate system operation to Owner's maintenance personnel and instruct them in operational and maintenance requirements.
- C. Verify that, where applicable, fans are interlocked with other fans as required by control drawings.

END OF SECTION 23 34 00

SECTION 23 36 00 AIR TERMINAL UNITS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Variable volume air terminal units to be pressure independent, single duct, DDC control type with hot water, reheat coil pre-assembled unit with factory installed piping and controls and shall be pre-commissioned.
- B. Air terminal unit airflow and sound performance ratings to be certified in accordance with AHRI Standard 880.

PART 2 – PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

- A. Provide terminal units with minimum 22-gauge welded galvanized steel housing, slip and drive duct connection, hanger holes or brackets, and 1/2 inch thick internal glass fiber insulation with a non-ablating, cleanable, sound attenuating liner. Insulation to be UL listed and meet NFPA- 90A and UL-181 requirements.
- B. Terminal units to be pressure independent. Terminal unit airflow to be monitored by an integral, multiple point, averaging airflow sensing ring or cross to maintain constant airflow within 5 percent of rated cfm down to 25 percent of nominal cfm, independent of changes in system static pressure. Sampling points to be evenly spaced across the air terminal box inlet for better readings. Factory set, field adjustable settings for terminal unit maximum and minimum airflows to be provided in accordance with schedule on drawings. Integral flow taps and calibration chart to be provided for each terminal unit.
- C. Internal resistance of terminal unit shall not exceed that scheduled on drawings when handling maximum scheduled air volumes.
- D. Terminal unit leakage rate to be maximum 1 percent of nominal cfm at 0.50" w.g. inlet static pressure.
- E. Maximum room N.C. due to discharge or radiated sound shall not exceed NC-35 when terminals are either in throttled or full open position with inlet static pressure ranging from 0.5 to 2" w.g. Correction of noise excesses not to constitute additional charges.
- F. Terminal units to be complete with factory installed, direct digital control actuator for connection to DDC controls provided by controls contractor.
- G. Provide factory mounted hot water reheat coils for terminal units scheduled on drawings in accordance with Section 23 82 16 Heating Coils. Minimum tube thickness of 0.016".
- H. Provide a discharge air temperature on each terminal unit. Temperature measurement to be 1000 Ohm RTD, 2-wire sensing element with +/- 0.3°F accuracy and a stability of less than 0.1°F in five years.
- I. Access Door: Provide insulated single wall access door to access terminal interior. Door should be 4-cam lock door with a piano hinge.
- J. Piping Components
 - 1. Box should be delivered pre-piped and pre-pressurized. Lines to be 1'-0" long

- and minimum of 3/4" in diameter.
2. Supply: Ball valve with stainless steel screen as a strainer with hose connection for drain and full size handle. Valve to have bronze body, chromium plated bronze ball, Teflon seats, stuffing box ring and seals, and quarter turn on-off.
 3. Return: Shutoff valve, air vent, PT (Pressure Temperature) test plug, and union. Valve to be ball type with bronze/brass body, 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.
 4. Auto control valve: Chrome plated brass ball type with characterized port to allow equal percentage throttling. Stainless steel stem with removable composition disc and self-adjusting spring-loaded Teflon packing. Valves shall have fully modulating electronic actuators. Actuators shall be proportional and accept a 0 - 10 vdc or 0 - 20 ma. Zone type, tri-state, pulse-type, or similar non-proportional control valves/actuators are not acceptable. Control valve to have unions on both sides of the valve.
- K. Shipping: All components to be adequately protected during shipping, pipes to be plugged to keep debris from getting into the pipe and fittings, pipe ends to be prevented from damage during shipping.
- L. Warranty: 1-year parts and labor warranty for all the parts of the pre-assembled air terminal box unit, with the exception of the controls contractor's scope of work.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install terminal units in strict accordance with manufacturers' published installation instructions.
- B. Terminal units to be supported directly from unit to structure with appropriate supports.

END OF SECTION 23 36 00

SECTION 23 40 00 HVAC AIR CLEANING DEVICES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install filters and factory-fabricated side access filter housings as scheduled on drawings with appropriate draft gauge(s).

1.2 QUALITY ASSURANCE

- A. All filters to meet NFPA 90A requirements for flammability.
- B. Filters with a 90% efficiency and less shall be tested in accordance with ASHRAE Standard 52.
- C. Filters with a 95% efficiency and higher shall be rated under the D.O.P. test requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. American Air Filter, Flanders, CamFilFarr, TriDim, and 3M.

2.2 MANOMETER

- A. Provide a Dwyer magnehelic gauge across each filter bank.
- B. Mark gauge to indicate design clean and dirty loading conditions.

2.3 MEDIUM-EFFICIENCY DISPOSABLE FILTERS

- A. Provide medium efficiency, disposable, pleated media filters at locations shown on drawings.
- B. Each filter shall consist of a non-woven cotton media, media support grid, and enclosing frame.
- C. Filter shall be listed by UL as Class II.
- D. Provide MERV 11 (60% efficiency) per ASHRAE Test Standard 52.
- E. 4-Inch Thick Media: Effective filter media area shall not be less than 4.6 square feet of media per square foot of face area.

2.4 HIGH-EFFICIENCY CARTRIDGE FILTERS

- A. Provide MERV 14 (90% efficiency) per ASHRAE Standard 52 to locations shown on drawings.
- B. 12-Inch Thick high-efficiency cartridge type filter.
- C. Filters to have average velocity through media of not more than 25 fpm.
- D. Filters to be selected in accordance with schedule for face velocity in order to produce efficiency and not exceed initial and final resistance as indicated on drawings.

2.5 HOLDING FRAMES

- A. Frames to be constructed of 16-gauge galvanized steel.
- B. Designed to provide a positive seal against leakage of unfiltered air.
- C. Pre-drilled for convenient assembly into banks.
- D. Integral spring type latches for holding filter against sponge rubber gaskets.
- E. Install frames to provide service from the dirty air side.
- F. The Cx authority shall inspect the filter arrangement for tight fit and absolute minimal bypass leakage around frame assembly and it shall be the responsibility of the contractor to correct any deficiencies prior to acceptance by the Owner.

2.6 SIDE ACCESS FILTER HOUSINGS

- A. Factory-assembled, 16-gauge galvanized steel construction.
- B. Flanges on both the air entering and leaving sides. Provide flush exterior for attaching to adjacent equipment.
- C. Extruded aluminum filter mounting tracks for each bank of filters.
- D. Individual sealing universal holding frames for each filter.
- E. Provide access doors with the following features:
 - 1. Located at one end of housing.
 - 2. Perimeter gasketing of neoprene rubber.
 - 3. Quick acting, spring-loaded latches.
 - 4. Plated hinges.
 - 5. Internally insulated with 1" thick insulation.
- F. Housing to be Farr Glide/Pack, American Air Filter Access Air Lever Lock, or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Provide filters and housings of size and capacities scheduled on drawings.
- B. Mount filters and housings at locations shown on drawings.
- C. Arrange apparatus casing to accommodate filter bank.
- D. Provide one complete change of filter media for each air handling unit, delivered to job site and turned over to Owner at final inspection.
- E. Install filters in accordance with manufacturers' published installation instructions.
- F. Install draft gauge(s) outside of air stream for each bank of filters.
- G. Protect heating coils, cooling coils, and ductwork with filter media during construction.
- H. Upon completion of ductwork and fan system, thoroughly clean systems and install specified filter media prior to placing system in operation.
- I. The installing contractor shall be responsible for providing a new set of clean filters during initial system startup and at the start of TAB fieldwork for all air handling units. In addition, temporary filter media shall be removed and final unit filters shall be installed prior to final unit setup by the TAB agency (i.e., prior to final unit traverse).

END OF SECTION 23 40 00

SECTION 23 64 10 -- AIR COOLED WATER CHILLERS

PART 1 GENERAL

1.1 SECTION INCLUDES (SUBMITTAL IS REQUIRED FOR EACH ITEM)

- A. Chiller package.
- B. Controls and control connections.
- C. Chilled water connections.
- D. Starters.

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC Systems.

1.3 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.
- B. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate valves, strainers, and valves required for complete system.
- C. Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.
- D. Submit written certification that components of package not furnished by manufacturer have been selected in accordance with manufacturers requirements.
- E. Submit manufacturer's installation instructions.

1.4 REFERENCES

- A. ANSI/ARI 550 - Rating Centrifugal and Rotary Chillers.
- B. ANSI/ARI 590 - Reciprocating Water - Chilling Packages.
- C. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
- E. ANSI/UL 465 - Central Cooling Air Conditioners.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operations data under provisions of Section 23 05 00.

- B. Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble- shooting guide.

1.6 REGULATORY REQUIREMENTS

- A. Conform to ANSI/ARI 590 code for testing and rating of reciprocating water chillers or ANSI/ARI Standard for rating centrifugal and rotary chillers.
- B. Conform to ANSI/UL 465 code for construction of water chillers and provide UL/ETL label.
- C. Conform to ANSI/ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of reciprocating water chillers.
- D. Conform to ANSI/ASHRAE 15 code for construction and operation of reciprocating water chillers.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products according to good construction practices.
- B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- C. Protect units on site from physical damage.

1.8 WARRANTY

- A. Provide five year warranty for compressor including parts, labor, and refrigerant.
- B. Warranty: Provide a manufacturer's full parts and labor warranty for one year from start-up or 18 months from shipment whichever occurs last.

1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance of complete assembly for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL UNIT DESCRIPTION

- A. Provide factory assembled and tested outdoor air cooled liquid chillers consisting of compressors, condenser, evaporator, expansion valve, refrigeration accessories, starter, and control panel. Construction and ratings shall be in accordance with ANSI/ARI 550 or ANSI/ARI 590 Standards.

2.2 COMPRESSORS

- A. Construct compressors with heat treated forged steel or ductile iron shafts, aluminum alloy connecting rods, automotive type pistons, rings to prevent gas leakage, discharge

valves, and sealing surface immersed in oil. Rotors shall be of high grade steel alloy.

- B. Statically and dynamically balance rotating parts.
- C. Provide oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation.
- D. Provide compressor with automatic capacity reduction equipment consisting of compressor start/stop or unloading. Compressor must start unloaded for soft start on motors.
- E. Provide constant speed 1800 or 3600 rpm compressor motor, suction gas cooled with solid state sensor and electronic winding overheating protection, designed for across-the-line or star delta starting. Furnish with starter. Compressor motor power factor shall be .90 or greater. If the compressor motor power factor is less than .90, power factor correction capacitors must be installed.
- F. Provide crankcase heater to evaporate refrigerant returning to crankcase during shut down. Energize heater when compressor is not operating.

2.3 EVAPORATOR

- A. Provide shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads, seamless internally finned copper tubes, roller expanded into tube sheets.
- B. Design, test, and stamp refrigerant side for 300 psig working pressure and water side for 215 psig working pressure, in accordance with ANSI/ASME SEC 8.
- C. Insulate with 0.75 inch minimum thick flexible elastomeric rubber closed cell insulation with maximum K value of 0.26. Provide heat tape to protect evaporator to -20 degrees F.
- D. Provide low point water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.
- E. Evaporator shall have only one entering and one leaving connection.
- F. Provide with heat tracing.

2.4 CONDENSER AND FANS

- A. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 500 psig.
- B. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Entire fan assembly shall be statically and dynamically balanced and fan assembly shall be either painted or zinc coated steel. Fan guard shall be either PVC, chrome or zinc coated.
- C. Provide factory guard panels. Guards shall cover condenser, evaporator and

compressor sections so all are covered.

- D. Provide fan motors with permanently lubricated ball bearings and built-in thermal overload protection.

2.5 ENCLOSURES

- A. House components in galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U.
- B. Unit panels, decorative louvered panels, and control panels shall be finished with a baked on powder paint. Control panel doors shall have door stays. Paint system shall meet the requirements for outdoor equipment. All doors shall be lockable.
- C. Mount starters and disconnects in weatherproof panel provided with full opening access doors. Provide means to lock disconnect.
- D. Casings fabricated from steel that do not have a Zinc coating conforming to ASTM A 123 or ASTM A525 shall be treated for the prevention of corrosion with a factory coating or paint system. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8 inch). The rating of the unscribed area shall not be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.

2.6 REFRIGERANT CIRCUIT

- A. All units shall have compressors as indicated.
- B. Provide for each refrigerant circuit:
 1. Liquid line shutoff valve.
 2. Filter dryer (replaceable core type).
 3. Liquid line sight glass and moisture indicator.
 4. Electronic or thermal expansion valve sized for maximum operating pressure.
 5. Charging valve.
 6. Discharge and oil line check valves.
 7. Compressor suction and discharge service valves.
 8. High side pressure relief valve.
 9. Full operating charge of R-22 and oil.
 10. Unit factory leak tested at 200 psig.

2.7 CONTROLS

- A. On chiller, mount weatherproof control panel, containing starters, power and control wiring, molded case disconnect switch (UL approved) with external lockable operator handle, factory wired with terminal block power connection. Provide single point power

connection on units with MCA less than 500 amps. Provide primary and secondary fused control power transformer and a single 115 volt single phase connection for evaporator heat tape. Provide BacNET interface for integration with building automation system.

B. Provide the following safety controls with indicating lights or diagnostic readouts.

1. Low chilled water temperature protection.
2. High refrigerant pressure.
3. Low oil flow protection.
4. Loss of chilled water flow.
5. Contact for remote emergency shut-down.
6. Loss of refrigerant charge protection.
7. Motor current overload.
8. Phase reversal/unbalance/single phasing.
9. Over/under voltage.
10. Failure of water temperature sensor used by controller.
11. Compressor status (on or off).

C. Provide the following operating controls:

1. Stepped leaving chilled water temperature controller which activates loading as indicated.
2. Five minute solid state anti-recycle timer to prevent compressor from short cycling.
3. Low ambient controls for operation down to 25 degrees F or lower.
4. Compressor current sensing unloader unit that unloads compressors to help prevent current overload nuisance tripouts.
5. Auto lead-lag functions that constantly evens out running hours and compressor starts automatically. If contractor can not provide this function then cycle counter and hour meter shall be provided so owner can be instructed by the contractor on how to manually change lead lag on compressors and even out compressor starts and running hours.
6. Low ambient lockout control with adjustable setpoint.
7. Condenser fan sequencing which automatically cycles fans in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing unit efficiency.

D. Provide pre-piped gauge board with pressure gauges for suction and discharge refrigerant pressures or digital display of pressures on microprocessor.

E. Provide ammeters for each compressor or digital display of % RLA on microprocessor.

2.8 BUILDING MANAGEMENT SYSTEM INTERFACE

- A. The chiller shall have the ability to accept a 4-20 mA control signal from building automation system for leaving water temperature and demand limiting setpoint adjustment. This shall not require additional software or hardware not provided on unit.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Align chiller package on concrete foundations.
- C. Connect to electrical service.
- D. Connect to chilled water piping. On inlet, provide thermometer well for temperature controller and other items as indicated on drawings.
- E. Arrange piping for easy dismantling to permit tube cleaning.
- F. The manufacturer shall coordinate with the controls contractor and provide interface devices required to interface with the building control system.
- G. Provide heat trace on evaporator.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems.
- B. Supply service of factory trained representative for a period of three days to supervise testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner.
- C. Supply initial charge of refrigerant and oil.

END OF SECTION

SECTION 23 73 13 -- AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes modular air-handling units with coils for indoor installations.

1.2 SUBMITTALS

- A. Product Data: For each type of modular indoor air-handling unit indicated. Include the following:
 - 1. Certified fan-performance curves with system operating conditions indicated.
 - 2. Certified fan-sound power ratings.
 - 3. Certified coil-performance ratings with system operating conditions indicated.
 - 4. Motor ratings, electrical characteristics, and motor and fan accessories.
 - 5. Material gages and finishes.
- B. Shop Drawings:
 - 1. 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.
 - 2. Wiring Diagrams: Power, signal, and control wiring.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain modular indoor air-handling units through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of modular indoor air-handling units and are based on the specific system indicated.
- 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. NFPA Compliance: Modular indoor air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
- E. ARI Certification: Modular indoor air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- F. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into slab.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- C. Coordinate size and location of structural-steel support members.

1.5 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. Filters: One (1) set for each modular indoor air-handling unit.
 - 2. Fan Belts: One (1) set for each modular indoor air-handling unit fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carrier; Div. of United Technologies Corp.
 - 2. Daikin Applied
 - 3. VTS Group.
 - 4. Trane

Manufacturers other than those listed above shall be required to get pre-approval in writing a minimum of 7 days prior to bid date.

2.2 MANUFACTURED UNITS

- A. Modular indoor air-handling units shall be factory assembled and consist of fans, motor and drive assembly, coils, damper, plenums, filters, condensate pans, control devices, and accessories.

2.3 CABINET

- A. Cabinet: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Shall be ASHRAE 111 Class 6 low-leak design.
 - 1. Outside Casing: G90 galvanized steel, 16 gauge frames and 18 gauge panels. Provide with thermal breaks to prevent exterior condensation from occurring.
 - 2. Inside Casing: 201 Stainless steel or BlyGold coated G40 galvanized steel.
 - 3. Floor Plate: 201 Stainless Steel or BlyGold coated G40 galvanized steel and capable of supporting a 300lb load with no more deflection than 0.0042 inch per inch of panel span.

4. Cabinet Insulation: Comply with NFPA 90A.
 - a. Thickness: 2 inch, R-13 foam insulated.
 - b. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50, when tested according to ASTM C 411.
 - c. Liner Adhesive: Comply with NFPA 90A and ASTM C 916.
 - d. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - e. Location and Application: Factory applied with adhesive or mechanical fasteners between inside and outside casings.
 5. Access Panels and Doors: Same materials and finishes as cabinet, complete with hinges, latches, handles, and gaskets. Inspection and access panels and doors shall be sized and located to allow periodic maintenance and inspections. Provide access panels and doors in the following locations:
 - a. Fan Section: Inspection and access panels.
 - b. Access Section: Doors.
 - c. Coil Section: Inspection panel.
 - d. Filter Section: Inspection and access panels to allow periodic removal and installation of filters.
 6. Condensate Drain Pans: Formed sections of stainless-steel sheet complying with requirements in ASHRAE 62. Fabricate pans to collect condensate from cooling coils (including coil piping connections and return bends) when units are operating at maximum catalogued face velocity across cooling coil.
 - a. Drain Connections: Threaded.
- B. Fan-Section Construction: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure and equipped with formed-steel channel base for integral mounting of fan, motor, and casing panels. Mount fan with vibration isolation. Backdraft dampers shall be provided for unit's with more than one fan.
1. Centrifugal Fan Housings: Formed- and reinforced-steel panels to make curved scroll housings with shaped cutoff, spun-metal inlet bell, and access doors or panels to allow entry to internal parts and components.
 - a. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - b. Performance Class: AMCA 99-2408, Class suitable for airflow and static pressure rating.
 - c. Horizontal Flanged Split Housing: Bolted construction.
 2. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower.
 3. Forward-Curved Fan Wheels: Galvanized-steel construction with inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.
 4. Shafts: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.

- b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 - 5. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: AFBMA-ANSI, L₅₀ of **200,000** hours.
 - b. Roller-Bearing Rating Life: AFBMA-ANSI, L₅₀ of **200,000** hours.
 - 6. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation and with **1.2** service factor based on fan motor.
 - a. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - b. 5-hp limit in first subparagraph below is standard with many manufacturers but is a designer's choice.
 - c. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - d. Belts: Oil resistant, nonsparking, and nonstatic; matched for multiple belt drives.
 - e. Belt Guards: Fabricate to OSHA/SMACNA requirements; **0.1046-inch**-thick, **3/4-inch** diamond-mesh wire screen welded to steel angle frame or equivalent; prime coated.
 - f. Motor Mount: Adjustable for belt tensioning.
 - 7. Vibration Control: Install fans on open-spring vibration isolators having a minimum of **1-inch** static deflection and side snubbers.
 - 8. Fan-Section Source Quality Control:
 - a. Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
 - b. Factory test fan performance for flow rate, pressure, power, air density, rotation speed, and efficiency. Establish ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."
- C. Motors: Refer to Division 23 Section "Motors" for general requirements.
 - 1. Torque Characteristics: Sufficient to accelerate driven loads satisfactorily.
 - 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range.
 - 3. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).
 - 4. Service Factor: 1.15 for polyphase motors and 1.0 for inverter duty.
 - 5. Motor Construction: NEMA MG 1, general purpose, inverter duty, Design B mounted on adjustable base.
 - 6. Motor Insulation: Insulation system shall exceed the NEMA MG-1 Part 31 Standard and shall be Class F minimum.
 - 7. Bearings: The following features are required:
 - a. Ball or roller bearings with inner and outer shaft seals.
 - b. Grease lubricated.
 - c. Designed to resist thrust loading where belt or other drives produce lateral or axial thrust in motor.
 - 8. Overload Protection: Built-in, automatically resetting, thermal-overload protection.
 - 9. Noise Rating: Quiet.

10. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled according to IEEE 112, Test Method B. If efficiency is not specified, motors shall have a higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B.
 11. Nameplate: Indicate ratings, characteristics, construction, special features, and full identification of manufacturer.
- D. Coil Sections: Common or individual, insulated, stainless-steel casings for cooling coils. Design and construct to facilitate removal and replacement of coil for maintenance and to ensure full airflow through coils.
- E. Water Coils: Continuous circuit coil fabricated according to ARI 410.
1. Piping Connections: Threaded, on same end.
 2. Tubes: Copper.
 3. Fins: Aluminum with fin spacing of no more than 10 fpi.
 4. Fin and Tube Joint: Mechanical bond.
 5. Headers: Seamless copper tube with brazed joints, prime coated.
 6. Casings: Stainless-steel channel frame, heavy duty.
 7. Provide with vent and drain connections.
 8. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - a. Working-Pressure Ratings: 250 psig, 300 deg F.
 9. Source Quality Control: Test to 300 psig underwater.
- F. Filters: Comply with Section 23 40 00 – HVAC Air Cleaning Devices and as scheduled on drawings.
- G. UVC Germicidal Lamps: UV-C light fixtures and lamps shall be provided by the air handler manufacturer. The UV-C fixtures shall be factory-assembled and tested in the air handler. Field-installed fixtures shall not be allowed. Design of the UV-C light array shall assure that the UV-C energy striking the intended coil and drain pan surfaces shall have an average intensity on the surface plane of the coil not less than 550 microwatts per square centimeter and provide not less than 99 percent surface disinfection efficiency. The minimum intensity at any point on the surface plane of the coil must exceed 100 microwatts per square centimeter. Energy consumption at the design intensity shall be no more than 10 watts for each square foot of treated, cross sectional plane.
1. Lamps: Lamps shall be installed in sufficient quantity and in such a manner so as to provide an equal distribution of UV-C energy. The UV-C energy produced shall be of the lowest possible reflected and shadowed-losses and shall provide 360 degree UV-C irradiance within the UV cavity. The lamps shall not produce ozone. Each lamp shall be high-output, hot cathode, T5 diameter, medium bi-pin type that produces UVC energy at 254 nanometers. Lamps shall contain no more than 5 milligrams of mercury and produce the specified UV-C output when installed in air of up to 600 fpm velocity and temperatures of 50-135 degrees F. Lamp life shall be 9,000 hours minimum with no more than a 15 percent loss of output after one year of use.
 2. Power Supply: The power supply housing shall be capable of installation within the air stream. Lamps shall be mounted to irradiate the intended surfaces as well as all of the available line of sight airstream from proper placement, 360° irradiation and incident angle reflection.
 3. Fixtures: Fixtures shall meet the UL drip-proof design criteria and be constructed to resist corrosion. Fixtures shall have been independently tested and recognized

by UL/C-UL under Category ABQK (Accessories, Air Duct Mounted), UL Standards 153, 1598 and 1995. Ballast enclosure and lamp support angles shall be constructed of galvanized steel.

4. Safety: Access doors shall be provided at the location of each UV-C light as indicated on the plans and schedule. All sections of the air handler with access doors where the UV-C lights may pose a risk for direct exposure shall have a mechanical interlock switch that disconnects power to the lights when the door is opened. In addition to the mechanical interlock switch, each unit shall be equipped with an externally mounted on-off/disconnect/shut off switch that disconnects power to the UV-C lights. The switch shall be equipped with a lock-out/tag-out to prevent unwanted operation of the UV- C lights. A view port shall be provided in or adjacent to each UV section to allow viewing of the UV-C light array confirming operation. The view port and other AHU windows shall be treated to assure the UV-C energy emitted through it is below the threshold limits specified by NIOSH and ACGIH. Units shall have a safety warning label applied to the exterior of each section containing UV-C lights. Complete safety, maintenance and servicing instructions for the UV-C lights and fixtures shall be incorporated into the air handler manufacturer's standard installation, operating and maintenance manuals.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install modular indoor air-handling units with the following vibration-control devices.
- B. Ground Floor, Floor-Mounted Units: Support on manufacturer provided base rails using neoprene pads between base rails and slab.
- C. Arrange installation of units to provide access space around modular indoor air-handling units for service and maintenance.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.

- C. Flexible connections in first paragraph below may not be necessary. Verify requirements with Project conditions.
- D. Connect piping to modular indoor air-handling units mounted on vibration isolators with flexible connectors.
- E. Connect condensate drain pans using NPS 1-1/4 (DN 32), Type M copper tubing. Extend to nearest floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- F. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Connect to supply and return coil tapings with shutoff or balancing valve and union or flange at each connection.
- G. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping." Connect to supply and return coil tapings with shutoff valve and union or flange at each connection.
- H. Coordinate duct installations and specialty arrangements with schematics on Drawings and with requirements specified in duct and duct accessory Specifications. If Drawings are explicit enough, these requirements may be reduced or omitted.
- I. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.
- J. Electrical: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.
- K. Ground equipment according to Division 26 Section "Grounding and Bonding."
- L. 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.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
 - 2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.

- B. Final Checks before Startup: Perform the following:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Perform cleaning and adjusting specified in this Section.
 - 4. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - 5. Set outside- and return-air mixing dampers to minimum outside-air setting.
 - 6. Comb coil fins for parallel orientation.
 - 7. Install clean filters.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
- C. Starting procedures for modular indoor air-handling units include the following:
 - 1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace motor pulleys as required to achieve design conditions.
 - 2. Measure and record motor electrical values for voltage and amperage.
 - 3. Manually operate dampers from fully closed to fully open position and record fan performance.
- D. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for modular indoor air-handling system testing, adjusting, and balancing.

3.6 CLEANING

- A. Clean modular indoor air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.
- B. After completing system installation and testing, adjusting, and balancing modular indoor air-handling and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular indoor air-handling units.

END OF SECTION 237313

SECTION 23 82 40 ELECTRIC HEATERS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide UL listed electric heaters of the type and capacities specified on drawings.
- B. Heaters to have a five-year warranty.
- C. Heaters to be by Markel, Berko, Q-Mark, or approved equal.

PART 2 – PRODUCTS

2.1 WALL-MOUNTED HEATERS

- A. Heaters to be Markel Series 3420 commercial service, wall-mounted, forced-air heaters.
- B. Enclosure to be minimum 16 ga. galvanized steel with baked enamel finish.
- C. Elements to be high mass, all steel finned tubular type.
- D. Motor to be equipped with permanently lubricated bearings and internal overload protection.
- E. Fan to be propeller type with fan speed not exceeding 1550 rpm.
- F. Heaters to be equipped with manual reset thermal cutouts to disconnect both heating elements and motor.
- G. Heaters to be designed for single point power connection, with elements, motor, and control circuits subdivided with factory installed and wired fuses.
- H. Thermostats to be low-voltage, unit mounted as scheduled on drawings, heavy-duty, tamperproof type. Manufacturer to furnish necessary contactors, relays, transformers, etc., for complete installation.
- I. See drawings for surface or recessed mounting requirements.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Heaters to be installed in accordance with manufacturers' published installation instructions.

END OF SECTION 23 82 40

SECTION 31 3116

TERMITE CONTROL

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Below grade soil treatment for termite control.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 SUBMITTALS

- A. Submittals for Review:
 - 1. Application Procedures: Indicate locations for application, application rates, and application equipment.
 - 2. Warranty: Sample warranty form.
- B. Quality Control Submittals:
 - 1. Current EPA approval listing.
 - 2. Certificates of Compliance: Applicator's certification that termiticide was applied at specified concentrations and using specified methods and materials.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: Licensed for termite control by authorities having jurisdiction.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect containers from accidental opening and use.

1.5 PROJECT CONDITIONS

- A. Do not apply termiticide when surface water is present.

1.6 SEQUENCING

- A. Apply termiticide:
 - 1. After completion of excavating, backfilling, and compaction.
 - 2. Prior to placing vapor retarder.

1.7 WARRANTIES

- A. Provide manufacturer's 5 year warranty against invasion or propagation of subterranean termites and damage to building or building contents caused by termites, including repairs to building and building contents.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Termiticide:
 - 1. Approved for termite treatment by Environmental Protection Agency and other authorities having jurisdiction.
 - 2. Water based solution, uniform in composition, synthetically dyed to permit visual identification of treated soil.

2.2 MIXES

- A. Mix materials in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.1 APPLICATION

- A. Apply materials in accordance with manufacturer's instructions.
- B. Inject treatment at minimum rates recommended by manufacturer.
- C. Apply treatment to areas beneath structures and outside of building perimeter to minimum 48 inch depth below grade.
- D. Saturate areas around floor slab penetrations.
- E. Prevent spillage and runoff onto adjacent non treated areas.
- F. Ensure complete coverage of treated areas.
- G. Extend treatment onto adjacent construction and floor slab penetrations.
- H. Reapply termiticide to treated soils that are disturbed after treatment.

END OF SECTION