100% Construction Document

Rifle Fire Protection District
Rifle Fire Station #3
April 13, 2009

PROJECT SPECIFICATION MANUAL

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GENERAL CONDITIONS

1. General Conditions: AIA A201, General Conditions of the Contract for Construction.

2. General Conditions: AIA A271, General Conditions of the Contract for Furniture, Furnishings and Equipment.

3. General Conditions Forms: General Conditions are available from the American Institute of Architects, Washington, D.C., 202-626-7300. General Conditions will be prepared and approved for use on the project by the Owner in consultation with an attorney.

END OF DOCUMENT

DOCUMENT 00800

SUPPLEMENTARY CONDITIONS

1. Supplementary Conditions: Supplementary Conditions will be prepared and approved for use on the project by the Owner in consultation with an attorney.

2. Supplementary Conditions Sample Language: Available from the American Institute of Architects, Washington, D.C., 202-626-7300. Supplementary Conditions will be prepared and approved for use on the project by the Owner in consultation with an attorney.

END OF DOCUMENT

SECTION 01100

SUMMARY

PART 1 GENERAL

1.1 SUMMARY

A. Project Identification: Rifle Fire Station

B. Project Summary: 10,500 SF single level structure with slab on grade. Project includes structural masonry, load bearing framed walls and pre-engineered steel trusses.

C. Permits and Fees: Apply for, obtain, and pay for permits, fees, and utility company backcharges required to perform the work. Submit copies to Architect.

D. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to Architect.

E. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. Do not scale drawings.

F. Existing Conditions: Notify Architect of existing conditions differing from those indicated on the drawings. Do not remove or alter structural components without prior written approval.

G. Coordination:
1. Coordinate the work of all trades.
2. Prepare coordination drawings for areas above ceilings where close tolerances are required between building elements and mechanical and electrical work.
3. Verify location of utilities and existing conditions.

H. Installation Requirements, General:
1. Inspect substrates and report unsatisfactory conditions in writing.
2. Do not proceed until unsatisfactory conditions have been corrected.
3. Take field measurements prior to fabrication where practical. Form to required shapes and sizes with true edges, lines and angles. Provide inserts and templates as needed for work of other trades.
4. Install materials in exact accordance with manufacturer's instructions and approved submittals.
5. Install materials in proper relation with adjacent construction and with proper appearance.
6. Restore units damaged during installation. Replace units which cannot be restored at no additional expense to the Owner.
7. Refer to additional installation requirements and tolerances specified under individual specification sections.

I. Limit of Use: Limit use of work as indicated. Keep driveways and entrances clear.

J. Existing Construction: Maintain existing building in a weathertight condition. Repair damage caused by construction operations. Protect building and its occupants.

K. Definitions:
   1. Provide: Furnish and install, complete with all necessary accessories, ready for intended use. Pay for all related costs.
   2. Approved: Acceptance of item submitted for approval. Not a limitation or release for compliance with the Contract Documents or regulatory requirements. Refer to limitations of 'Approved' in General and Supplementary Conditions.
   3. Match Existing: Match existing as acceptable to the Owner.

L. Intent: Drawings and specifications are intended to provide the basis for proper completion of the work suitable for the intended use of the Owner. Anything not expressly set forth but which is reasonable implied or necessary for proper performance of the project shall be included.

M. Writing Style: Specifications are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is the Contractor. For example, 'Provide tile' means 'Contractor shall provide tile.'

PART 2 PRODUCTS - Not Applicable To This Section

PART 3 EXECUTION - Not Applicable To This Section

END OF SECTION

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Administration of Contract: Provide administrative requirements for the proper coordination and completion of work including the following:
   1. Supervisory personnel.
   2. Preconstruction conference.
   3. Project meetings, minimum of two per month; prepare and distribute minutes.

B. Reports: Submit daily and special reports.

C. Work Schedule: Submit progress schedule, updated monthly.

D. Submittal Schedule: Prepare submittal schedule; coordinate with progress schedule.

E. Schedule of Values: Submit schedule of values.

F. Schedule of Tests: Submit schedule of required tests including payment and responsibility.

G. Perform Surveys: Lay out the work and verifying locations during construction. Perform final site survey.

H. Emergency Contacts: Submit and post a list of emergency telephone numbers and address for individuals to be contacted in case of emergency.

I. Record Documents: Submit record drawings and specifications; to be maintained and annotated by Contractor as work progresses.

1.2 SUBMITTALS

A. Types of Submittals: Provide types of submittals listed in individual sections and number of copies required below.
   1. Shop drawings, reviewed and annotated by the Contractor - 5 copies.
   2. Product data - 5 copies.
   3. Samples - 1, plus extra samples as required to indicate range of color, finish, and texture to be expected.
   4. Inspection and test reports - 5 copies.
   5. Warranties - 2 copies.
   6. Survey data - 2 copies.
   7. Closeout submittals - 2 copies.

B. Submittal Procedures: Comply with project format for submittals. Comply with submittal procedures established by Architect including Architect's submittal and shop drawing stamp. Provide required resubmittals if original submittals are not approved. Provide distribution of approved copies including modifications after submittals have been approved.

C. Samples and Shop Drawings: Samples and shop drawings shall be prepared specifically for this project. Shop drawings shall include dimensions and details,

including adjacent construction and related work. Note special coordination required. Note any deviations from requirements of the Contract Documents.

D. Warranties: Provide warranties as specified; warranties shall not limit length of time for remedy of damages Owner may have by legal statute. Contractor, supplier or installer responsible for performance of warranty shall sign warranties.

PART 2 PRODUCTS - Not Applicable To This Section

PART 3 EXECUTION - Not Applicable To This Section

END OF SECTION

SECTION 01400

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Quality Monitoring: Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality. Perform quality control procedures and inspections during installation.

B. Standards: Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

C. Tolerances: Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate. Comply with manufacturers' tolerances.

D. Reference Standards: For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

E. Manufacturer's Field Services: When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to perform the following as applicable, and to initiate instructions when necessary.
1. Observe site conditions.
2. Conditions of surfaces and installation.
3. Quality of workmanship.
4. Start-up of equipment.
5. Test, adjust and balance of equipment.

F. Mock-Ups: Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes. Accepted mock-ups shall be a comparison standard for the remaining Work.

G. Removal of Mock-Ups: Where mock-up has been accepted by Architect and no longer needed, remove mock-up and clear area when directed to do so.

PART 2 PRODUCTS - Not Applicable To This Section

PART 3 EXECUTION - Not Applicable To This Section

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Temporary Services: Provide temporary services and utilities, including payment of utility costs including the following.
   1. Water (potable and non-potable).
   2. Lighting and power.
   3. Metering.
   4. Telephone.
   5. Toilet facilities.
   6. Materials storage.

B. Construction Facilities: Provide construction facilities, including payment of utility costs including the following.
   1. Construction equipment.
   2. Dewatering and pumping.
   3. Enclosures.
   4. Heating.
   5. Lighting.
   6. Elevator.
   7. Access.
   8. Roads.

C. Security and Protection: Provide security and protection requirements including the following.
   1. Fire extinguishers.
   2. Site enclosure fence, barricades, warning signs, and lights.
   3. Building enclosure and lock-up.
   4. Environmental protection.
   5. Pest control during and at the end of construction.
   6. Snow and ice removal if applicable.

D. Personnel Support: Provide personnel support facilities including the following.
   1. Architect's field office with telephone, fax and data connection.
   2. Contractor's field office.
   3. Sanitary facilities.
   4. Drinking water.
   5. Project identification sign.
   6. Cleaning.

PART 2 PRODUCTS

2.1 TEMPORARY BRACING

A. Temporary Bracing of Masonry Parititons: As required to stabilize construction during installation of masonry work.

PART 3 EXECUTION - Not Applicable To This Section

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Manufactures: Provide products from one manufacturer for each type or kind as applicable. Provide secondary materials as acceptable to manufacturers of primary materials.

B. Product Selection: Provide products selected or equal approved by Architect. Products submitted for substitution shall be submitted with complete documentation, and include construction costs of substitution including related work.

C. Substitutions: Request for substitution must be in writing. Conditions for substitution include:
1. An 'or equal' phrase in the specifications.
2. Specified material cannot be coordinated with other work.
3. Specified material is not acceptable to authorities having jurisdiction.
4. Substantial advantage is offered to the Owner in terms of cost, time, or other valuable consideration.

D. Substitution Requests: Substitutions shall be submitted prior to award of contract, unless otherwise acceptable. Approval of shop drawings, product data, or samples containing substitutions is not an approval of a substitution unless an item is clearly presented as a substitution at the time of submittal.

PART 2 PRODUCTS - Not Applicable To This Section

PART 3 EXECUTION - Not Applicable To This Section

END OF SECTION

SECTION 01700

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Substantial Completion: The following are prerequisites to substantial completion. Provide the following.
   1. Punch list prepared by Contractor and subcontractors as applicable.
   2. Supporting documentation.
   3. Warranties.
   4. Certifications.
   5. Occupancy permit.
   6. Start-up and testing of building systems.
   7. Change over of locks.
   8. Meter readings.
   9. Commissioning documentation.

B. Final Acceptance: Provide the following prerequisites to final acceptance.
   1. Final payment request with supporting affidavits.
   2. Completed punch list.

C. As-Built Drawings: Provide a marked-up set of drawings including changes, which occurred during construction.

D. Project Closeout: Provide the following during project closeout.
   1. Submission of record documents.
   2. Submission of maintenance manuals.
   3. Training and turnover to Owner's personnel.
   4. Final cleaning and touch-up.
   5. Removal of temporary facilities.

PART 2 PRODUCTS - Not Applicable To This Section

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

A. Cutting and Patching: Provide cutting and patching work to properly complete the work of the project, complying with project requirements for:
   1. Structural work.
   2. Mechanical/electrical systems.
   3. Visual requirements, including detailing and tolerances.
   4. Operational and safety limitations.
   5. Fire resistance ratings.
   6. Inspection, preparation, and performance.
   7. Cleaning.

B. Means and Methods: Do not cut and patch in a manner that would result in a failure of the work to perform as intended, decrease energy performance, increase maintenance, decrease operational life, or decrease safety performance.

C. Inspection: Inspect conditions prior to work to identify scope and type of work

required. Protect adjacent work. Notify Owner of work requiring interruption to building services or Owner's operations.

D. Performance of Operations: Perform work with workmen skilled in the trades involved. Prepare sample area of each type of work for approval.

E. Cutting: Use cutting tools, not chopping tools. Make neat holes. Minimize damage to adjacent work. Inspect for concealed utilities and structure before cutting.

F. Patching: Make patches, seams, and joints durable and inconspicuous. Comply with tolerances for new work.

G. Cleaning: Clean work area and areas affected by cutting and patching operations.

END OF SECTION

SECTION 02010

SUBSURFACE INVESTIGATION

PART 1 GENERAL

1.1 SUMMARY

A. Geotechnical Report: A copy of the geotechnical report and boring logs are available from the Architect and Owner.

B. Information Not Guaranteed: Information on the Drawings and in the Project Manual relating to subsurface conditions and existing utilities and structures is from information available from sources available to the Owner's engineering consultants. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

PART 2 PRODUCTS - Not Applicable To This Section

PART 3 EXECUTION - Not Applicable to This Section

END OF SECTION

SECTION 02751 - CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cement concrete pavement for the following applications:

1. Driveway Apron.

1.2 SUBMITTALS

A. Product Data: For each manufactured material and product indicated.

B. Design Mixes: For each concrete mix indicated.

C. Material certificates.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Plain Steel Wire: ASTM A 82, as drawn.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening steel reinforcement. Manufacture bar supports according to CRSI's "Manual of Standard Practice.

2.2 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type II.

1. Fly Ash: ASTM C 618, Class F or C.
2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Aggregate: ASTM C 33, uniformly graded, from a single source.

C. Water: ASTM C 94.

D. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inch (13 to 38 mm) long.

E. Admixtures: Certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures, as follows:

1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

F. Curing Materials:

1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
3. Water: Potable.
4. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
5. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
6. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
7. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

G. Related Materials:

1. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.3 CONCRETE MIXES AND MIXING

A. Concrete Mixes: Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, with the following properties:

1. Compressive Strength (28 Days): 4000 psi
2. Maximum Water-Cementitious Materials Ratio: 0.48
3. Slump Limit: 4 inches
4. Air Content: 4.5 to 7.5 percent

B. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m).

C. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

D. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.

E. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Surface Preparation: Proof-roll prepared subbase, and remove loose material from surface.

B. Forms: Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations.

C. Reinforcement: Accurately position and support reinforcement, and secure against displacement. Set wire ties with ends directed into concrete.

1. Install welded wire fabric in lengths as long as practicable; lap at least one full mesh, and lace splices with wire.

D. Joints: Locate and install construction, isolation, contraction, and expansion joints as indicated.

E. Concrete Placement: Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete. Place concrete in a continuous operation within planned joints or sections.

1. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
2. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping according to recommendations in ACI 309R.
3. Screed and initial-float concrete surfaces with darby or bull float before excess moisture or bleed water appears on the surface.
4. Protect concrete from cold or hot weather during mixing, placing, and curing.

F. Evaporation Retarder: Apply to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

G. Pavement Tolerances: Comply with tolerances in ACI 330.1, "Specification for Plain Concrete Parking Lots."

3.2 FINISHES AND CURING

A. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surfaces to true planes with gaps below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm). Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

B. Curing: Begin curing after finishing concrete, but not before free water has disappeared from concrete surface. Cure concrete by one or a combination of the following methods:

1. Moisture cure concrete by water, continuous fog spray, continuously wet absorptive cover, or by moisture-retaining-cover curing. Keep surfaces continuously moist for not less than seven days.
2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.3 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.

C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

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

B. See Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.

1.2 SUBMITTALS

A. Product Data: For each manufactured material and product indicated.

B. Design Mixes: For each concrete mix indicated.

C. Shop Drawings: Include details of steel reinforcement placement including material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports.

D. Material: Test results

1.3 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.
6. Lightweight concrete.

C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Formwork: Furnish formwork and form accessories according to ACI 301.

B. Steel Reinforcement:

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), 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.
4. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

C. Concrete Materials:

1. Portland Cement: ASTM C 150, Type II Low Alkali
2. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1inch nominal size.
3. Lightweight Aggregate: ASTM C 330.
4. Water: Complying with ASTM C 94.
5. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

D. Admixtures:

1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

E. Vapor Retarder: Multi-ply reinforced polyethylene sheet, ASTM E 1745, Class C, not less than 7.8 mils (0.18 mm) thick; or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

F. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber

G. Curing Materials:

1. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
2. Water: Potable.
3. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.2 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): 3000 psi at Footings and stem walls

2. Compressive Strength (28 Days): 4000 psi at Structural floors/decks and flat work.
3. Slump: 4 inches +or- 1" No water shall be added on site.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6.0 percent within a tolerance of plus 1.0 or minus 2.0 percent.

1. Air content of trowel-finished interior concrete floors shall not exceed 3.0 percent.

D. Lightweight Structural Concrete Mix: ASTM C 330, proportioned to produce concrete with a minimum compressive strength of 3000 psi (20.7 MPa) at 28 days and a calculated equilibrium unit weight of 110 lb/cu. ft. (1762 kg/cu. m) plus or minus 3 lb/cu. ft. (48 kg/cu. m), as determined by ASTM C 567. Concrete slump at point of placement shall be the minimum necessary for efficient mixing, placing, and finishing.

1. Limit slump to 5 inches (125 mm) for troweled slabs and 4 inches (100 mm) for other slabs.

E. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m)

2.3 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with ASTM C 94

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. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).

C. 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

3.1 INSTALLATION, GENERAL

A. Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.

B. Vapor Retarder: Install, protect, and repair vapor-retarder sheets according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
2. Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

C. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

D. 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 equal to at least one-fourth of the concrete thickness, 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 (3 mm). 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- (3-mm-)

wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

E. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.2 CONCRETE PLACEMENT

A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

B. Do not add water to concrete during delivery, at Project site, or during placement.

C. Consolidate concrete with mechanical vibrating equipment.

3.3 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.4 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, portland cement terrazzo, 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, built-up or membrane roofing, or sand-bed terrazzo.

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, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

3.5 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-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 (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Coordinate the type and application of the curing compound with the finishing requirements and materials of all exposed decorative concrete.

E. When ambient air temperature is below 40 degrees F, concrete shall be heated and covered for a minimum of three days after placement per Cold Weather ACI 306.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Contractor 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.

B. Mix design shall be submitted to Architect for review by Engineer a minimum of one week prior to first concrete delivery.

1. Testing Frequency: At least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

END OF SECTION 03300

SECTION 04800

MASONRY ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Provide unit masonry construction.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
1. Shop drawings shall be prepared and stamped by a qualified engineer licensed in the jurisdiction of the project.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

1.3 QUALITY ASSURANCE

A. Fire Performance for Fire-Rated Brick and Concrete Block Assemblies: ASTM E 119.

B. Testing: Independent Testing Laboratory.

C. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship.

D. 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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete Masonry Units:
1. Manufacturers: Robinson Brick Yard (303) 783-3000, The Brick Yard (970) 242-5575
2. Application: Refer to structural drawings for load bearing masonry wall design.
3. Application: Masonry wall veneer.
4. 4” thick by 7-5/8 inches high by 15-5/8 inches long smooth faced Concrete Masonry Units: ASTM C 90, 1500 f'm compressive strength:
a. Medium weight.
5. 4” thick by 7-5/8 inches high by 15-5/8 inches long split faced Concrete Masonry Units: ASTM C 90, 1500 f'm compressive strength:
a. Medium weight.
6. Modular face brick: running bond pattern

B. Mortar and Grout for Brick and Concrete Masonry Unit Assemblies:
   1. Manufacturers: Dur-O-Wal; Hohmann & Barnard, Inc.; ProSpec (formerly Bonsal branded products); Quikrete Companies
   2. Mortar Mix: ASTM C 270, Type S, for reinforced masonry, masonry below grade and masonry in contact with earth and ASTM C 270, Type N, for above-grade loadbearing and nonloadbearing walls and parapet walls and for interior loadbearing and nonloadbearing partitions.
   3. Mortar Materials: Portland cement, ASTM C 150, Type I or II.
   4. Mortar Materials: Masonry cement, ASTM C 91.
   5. Mortar Materials: Ready mixed, ASTM C 207, Type S.
   6. Mortar Aggregate: color to be determined, ASTM C 144.
   7. Mortar Aggregate: color to be determined, ASTM C 144.
   8. Mortar Aggregate: color to be determined, ASTM C 144.
   9. Grout Aggregate: ASTM C 404.
   10. Hydrated Lime: ASTM C 207, Type S.
   11. Color: to be determined.
   12. Color: Colored pigmented mortar where exposed at building exterior and natural color elsewhere.

C. Ties and Anchors:
   1. Manufacturers: Blok-Lok Ltd.; Heckmann Building Products, Inc.; Hohmann & Barnard, Inc.; Powers Fasteners; Wire-Bond.
   2. Bent Wire Ties: Galvanized steel.
   3. Rigid Anchors: Galvanized steel straps.
   4. Masonry to Concrete Frame: Two-piece galvanized steel anchor.
   5. Masonry to Steel Frame: Anchor with crimped wire anchor section for welding to steel.
   6. Adjustable Masonry Veneer Anchors: Screw-attached two-piece galvanized triangular or rectangular wire tie and metal anchor.
   7. Screws for Steel Studs: ASTM C 954 organic polymer coated steel drill screws.
   8. Screws for Steel Studs: ASTM C 954 stainless steel.
   9. Unit Type Masonry Inserts in Concrete: Malleable iron.
   10. Dovetail Slots: Galvanized sheet metal.
   11. Anchor Bolts: ASTM A 307, Grade A, galvanized.
   12. Post-installed Anchors: Chemical or expansion anchors.

D. Masonry Accessories:
   1. Manufacturers: Advanced Building Products, Inc.; Davis Colors; Heckmann Building Products, Inc.; Hohmann & Barnard, Inc.; Mortar Net USA Limited; Sandell Construction Solutions; Stone Age Designs, LLC; Wire-Bond.
   2. Cavity Drainage Material
   3. Rubberized-Asphalt or EPDM Flashing with stainless steel drip edge.
   4. Stainless steel or copper-laminated flashing.
   5. Loose-Granular Fill Insulation.
   6. Nonmetallic expansion joint strips.
   7. Preformed control joint gaskets.
   8. Bond breaker strips.
   9. Plastic tubing for weeps.
   10. Cotton sash cord for weeps.
   11. Open head-joint weeps.
   12. Cavity vents.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation of Masonry Assemblies:
   1. Comply with PCA Recommended Practices for Laying Concrete Block, Brick Institute of America BIA Tech Notes, and NCMA TEK Bulletins.
   2. Comply with cold weather and warm weather protection procedures as recommended in BIA Tech Notes.
   3. Provide fire-rated assemblies complying with ASTM E 119.
   4. Sawcut units when required. Maintain uniform joint width. Provide full bed, head and collar joints except at weepholes.
   5. Install lintels and accessories in masonry construction.
   6. Coordinate installation of flashings.
   7. Comply with applicable codes and regulations for spacing of ties and horizontal reinforcing.
   8. Provide expansion and control joints in accordance with BIA and NCMA recommendations.
   9. Remove and replace damaged units.
   10. Clean brick using bucket and brush method, BIA Tech Note 20.
   11. Clean concrete masonry by dry brushing, NCMA TEK No. 28.

END OF SECTION

SECTION 04860 - STONE VENEER ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. This Section includes stone veneer in the following applications:

1. On concrete retaining walls.
2. Anchored to formed concrete wall backup.
3. Anchored to wood framing and sheathing.
4. Battered face types.
5. Walls and Piers.

B. Submittals: Samples for [stone] [and] [pointing mortar].

C. Submit qualification data for masonry contractor, including a list of completed projects.

D. Construct a sample wall panel approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high to demonstrate aesthetic effects and set quality standards for materials and execution.

E. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Comply with cold-weather construction requirements contained in [ACI 530.1/ASCE 6/TMS 602] [Section 2104.3 of the Uniform Building Code].

PART 2 - PRODUCTS

2.1 STONE

A. Stone Type: Per Architectural

B. Stone Classification:

1. As clarified under the marble Institute of America and ASTM Standards.

a. Absorbtion by weight, max. %	Contractor to verify
b. Compressive strength, min., psi	Contractor to verify
c. Modulus of rupture min., psi	Contractor to verify

2.2 MORTAR

A. Mortar for Stone Masonry Veneer: [ASTM C 270] [UBC Standard 21-15], Proportion Specification, Type [S] [N] for setting stone, Type [N] [O] for pointing.

1. Masonry Cement: [Do not use masonry cement] .
2. Low-Alkali Cement: For limestone, use portland cement with not more than 0.60 percent total alkali per ASTM C 114.
3. Colored Pointing Mortar: Use colored cement or cement-lime mix of color selected.

B. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.

1. Latex Additive:

C. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, and 5 parts sand.

D. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, and 7 parts sand.

2.3 STONE MASONRY-VENEER ANCHORS

A. Adjustable Veneer Anchors: Two-piece adjustable masonry veneer anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to studs, and acceptable to authorities having jurisdiction.

B. Corrugated-Metal Veneer Anchors: [Hot-dip galvanized steel] [Stainless-steel], 0.030-inch- (0.76-mm-) thick by 7/8-inch- (22-mm-) wide.

C. Wire Veneer Anchors: [Hot-dip galvanized steel] [Stainless-steel], 0.148 inch (3.8 mm) in diameter.

2.4 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashing: [Stainless steel, 0.0156 inch (0.4 mm) thick] [Copper, 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.3 mm) thick for fully concealed flashing, 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.5 mm) thick elsewhere].

B. Laminated Flashing: Copper sheet [7 oz./sq. ft. (2 kg/sq. m)], bonded with asphalt between 2 layers of glass-fiber cloth.

2.5 MISCELLANEOUS MATERIALS

A. Weep Holes: [Round polyethylene tubing, 3/8-inch (9.5-mm) OD] [Cotton or polyester rope, 1/4 to 3/8 inch (6 to 10 mm) in diameter, 24 inches (600 mm) long].

B. Cavity Drainage Material: 1-inch- (25-mm-) thick, free-draining mesh made from polyethylene strands.

1. Available]Products:

a. Advanced Building Products, Inc.; Mortar Break.
b. CavClear; CavClear Masonry Mat.
c. Mortar Net USA, Ltd.; Mortar Net.
d. Polytite Manufacturing Corp.; Mortar Stop.

C. Expanded Metal Lath: ASTM C 847, 3.4 lb/sq. yd. (1.8 kg/sq. m), galvanized, self-furring, diamond-mesh lath.

D. Welded-Wire Lath: ASTM C 933.

E. Acidic Masonry Cleaner.

2.6 STONE FABRICATION

A. Gage backs of stones more than 81 sq. in. (522 sq. cm) in area.

B. Thickness of Stone Masonry Veneer: [4 inches (100 mm) plus or minus 1/4 inch (6 mm)] [4 inches (100 mm) plus or minus 1/2 inch (13 mm)] [1 inch (25 mm) plus or minus 1/4 inch (6 mm)].

C. Type of Masonry (Pattern): Match sample

D. Finish: [Split face] [Rock face (pitched face)] [Natural cleft] [Mixed split face and seam face], to be determind.

PART 3 - EXECUTION

3.1 SETTING STONE MASONRY VENEER, GENERAL

A. Accurately mark stud centerlines on face of building paper or building wrap before beginning stone installation.

B. Execute stone masonry veneer by skilled masons experienced with the kind and form of stone and installation method indicated. Arrange stones for good fit, in pattern indicated.

C. Maintain uniform joint widths of [1/4 to 1/2 inch (6 to 13 mm)] [3/8 to 1/2 inch (10 to 13 mm)] [3/8 to 5/8 inch (10 to 16 mm)], except for variations due to stone size variations and minor variations required to maintain bond alignment.

D. Install concealed flashing and weep holes at shelf angles, lintels, ledges, and similar obstructions to downward flow of water.

1. Extend flashing 4 inches (100 mm) into masonry at each end and turn up 2 inches (50 mm) to form a pan.

E. Coat limestone with dampproofing on beds, joints, and back surfaces to at least 12 inches (300 mm) above finish-grade elevations, and on face surfaces up to finish-grade elevations.

3.2 INSTALLING ANCHORED STONE MASONRY VENEER

A. Set stone in full bed of mortar with full head joints. Build veneer anchors into mortar joints as stone is set.

1. Embed veneer anchors in mortar joints to within 1-1/2 inches (38 mm) of face.
2. Space veneer anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 18 inches (457 mm) o.c. horizontally. Install additional veneer anchors within 12 inches (305 mm) of openings and at intervals around perimeter not exceeding 12 inches (305 mm).

B. Provide 1-inch (25-mm) air space between stone masonry veneer and back-up construction, unless otherwise indicated. Keep air space free of mortar droppings and debris.

C. Rake out joints for pointing 1/2 inch (13 mm) deep.

3.3 INSTALLING ADHERED STONE MASONRY VENEER

A. Install lath over sheathing and asphalt-saturated felt by fastening through sheathing into framing to comply with ASTM C 1063.

B. Install lath over unit masonry and concrete to comply with ASTM C 1063.

C. Install 3/8-inch- (10-mm-) thick scratch coat over metal lath. Coat backs of stone units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Tap units into place, completely filling space between units and scratch coat.

D. Rake out joints for pointing 1/2 inch (13 mm) deep.

3.4 POINTING

A. Point stone joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

B. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce joint profile indicated.

3.5 CLEANING

A. Clean masonry as work progresses. Remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly cured, remove large mortar particles, scrub, and rinse stone masonry veneer.

1. Wet wall surfaces with water before applying acidic cleaner, then remove cleaner promptly by rinsing thoroughly with clear water.

END OF SECTION 04860

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes structural steel and grout.

1.2 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2, Part 9 or AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

C. Welding certificates.

D. Mill test reports.

E. Source quality-control test reports.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

C. Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992

B. Channels, Angles, MC and S Shapes: ASTM A 36/A 36M

C. Plate and Bar: ASTM A 36/A 36M or A 992

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain
2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8,) compressible-washer type.

a. Finish: Plain

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers, plain.

1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M,) Type 10.9, compressible-washer type, plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36; ASTM F 1554, Grade 55, weldable.

1. Configuration: Straight
2. Finish: Plain

E. Headed Anchor Rods: ASTM F 1554, Grade 36; ASTM F 1554, Grade 55, weldable, straight.

1. Finish: Plain

F. Threaded Rods: ASTM A 36/A 36M

1. Finish: Plain

2.3 PRIMER

A. Primer: SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd.

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."

B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. 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 (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Comply with testing and inspection requirements of Part 3, Article "Field Quality Control."

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding.

PART 3 - EXECUTION

3.1 ERECTION

A. Examination: Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

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

B. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design Load and Resistance Factor Design Specification for Structural Steel Buildings."

C. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.

1. Set base plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.2 FIELD CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 05120

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Noncomposite form deck.

1.2 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Include layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. Product certificates.

D. Welding certificates.

E. Research/evaluation reports.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

C. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C.

1. Nucor Corp.; Vulcraft Div.
2. United Steel Deck, Inc.
3. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

2.2 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 29, the minimum section properties indicated, and the following:

1. Prime-Painted Steel Sheet: ASTM A 611, Grade C or D minimum, with top surface phosphatized and unpainted and bottom surface shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; with unpainted top and bottom surface cleaned, pretreated, and primed with manufacturer's baked-on, lead- and chromate-free rust-inhibitive primer.
4. Profile Depth: 1-1/2 inches (38 mm)
5. Design Uncoated-Steel Thickness: See plans for thickness

2.3 ACCESSORIES

A. Accessories: Steel deck manufacturer's standard accessory materials, including mechanical fasteners, closure strips, pour stops, and closures for deck.

B. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.

C. Repair Paint: Lead- and chromate-free rust-inhibitive primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.

B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

C. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

1. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

G. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Butt end joints of deck panels; do not overlap. Remove and discard arc shields after welding shear connectors.

H. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

I. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.

J. Repairs and Protection:

1. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
2. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

3.2 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

B. Field welds will be subject to inspection.

C. Shear connector stud welds will be tested and inspected according to AWS D1.1.

D. Remove and replace work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 05310

Rifle, CO April 7, 2009

SECTION 05400

COLD-FORMED METAL FRAMING

Display hidden notes to specifier by using "Tools"/"Options"/"View"/"Hidden Text".

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cold-formed metal framing for walls.

B. Cold-formed metal framing for floors.

1.2 RELATED SECTIONS

A. Section 07200 – Thermal Protection

B. Section 09110 - Non-Structural Metal Framing

C. Section 09260 - Gypsum Board Assemblies.

1.3 REFERENCES

A. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

B. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

C. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

D. ASTM C 954 – Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inches to 0.112 inches in thickness.

E. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

F. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

G. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

H. AISI - Standard for Cold-Formed Steel Framing General Provisions.

I. AISI - North American Specification for the Design of Cold-Formed Steel Structural Members.

J. AWS D.1.3 - Structural Welding Code - Sheet Steel.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. [Product Data]: Submit manufacturer's product literature, data sheets and installation recommendations for specified products.

C. Structural Calculations: Submit structural calculations prepared by manufacturer for approval. Submittal shall be sealed by a professional engineer registered in the state of the project.
1. Description of design criteria.
2. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
3. Selection of framing components, accessories and welded connection requirements.
4. Verification of attachments to structure and adjacent framing components.
5. Engineer shall have a minimum of 5 years experience with projects of similar scope.

D. Shop Drawings:
1. Submit shop drawings prepared by the cold-formed metal framing manufacturer showing plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes.
2. Show connection details with screw types and locations, weld lengths and locations, and other fastener requirements.
3. Where prefabricated or pre-finished panels are to be provided, provided drawings depicting panel configurations, dimensions and locations.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

B. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with

identification labels intact.

B. Protect and store materials protected from exposure to rain, snow or other harmful weather conditions. Products to be handled per AISI "Code of Standard Practice"

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Dietrich Metal Framing; 200 Old Wilson Bridge Road, Columbus, OH 43085. ASD. Tel: (614) 840-4350. Fax: (614) 840-4351. Email: askforhelp@dietrichindustries.com; Web: www.dietrichmetalframing.com
   1. Dietrich Metal Framing; 8911 Bethlehem Blvd., Baltimore, MD (410) 477-8700
   2. Dietrich Metal Framing; 4200 Cedar Blvd., Baytown, TX (281) 383-1617
   3. Dietrich Metal Framing; 100 Fulton Street, Boonton, NJ (973) 335-3240
   4. Dietrich Metal Framing; 2001 Cooley Drive, Colton, CA (909) 824-9717
   5. Dietrich Metal Framing; 6700 Franklin Street, Denver, CO (303) 289-4092
   6. Dietrich Metal Framing; 1435 165th Street, Hammond, IN (219) 931-3741
   7. Dietrich Metal Framing; 91-300 Hanua Street, Kapolei, HI (808) 682-5747
   8. Dietrich Metal Framing; 1012 W. Wintergreen Rd; Hutchins, TX ((972) 225-1100
   9. Dietrich Metal Framing; 3901 Olympic Blvd., Joliet, IL (815) 207-0110
   10. Dietrich Metal Framing; 15546 West 108th Street, Lenexa, KS (913) 599-2026
   11. Dietrich Metal Framing; 330 Greenwood Place, McDonough, GA (678) 304-5500
   12. Dietrich Metal Framing; 3505 NW 123rd Street, Miami, FL (305) 652-5423
   13. Dietrich Metal Framing; 420 South 53rd Avenue, Phoenix, AZ (602) 447-0204
   14. Dietrich Metal Framing; 2525 South Airport Way, Stockton, CA (209) 547-9066
   15. Dietrich Metal Framing; 1300 Phoenix Road NE, Warren, OH (330) 372-4014

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 COMPONENTS

A. Studs: Cold-formed galvanized steel C-studs; by Dietrich Metal Framing
   1. Size: 1-3/8 inch (35 mm) flange width, 3/8 inch (9.5 mm) returns, and web depth as indicated on drawings; Series CWN.
   2. Size: 1-5/8 inch (41 mm) flange width, 1/2 inch (12.7 mm) returns, and web depth as indicated on drawings; Series CSJ.
   3. Size: 2 inches (51 mm) flange width, 5/8 inch (15.9 mm) returns, and web depth as indicated on drawings; Series CSW.
   4. Size: 2-1/2 inch (64 mm) flange width, 5/8 inch (15.9 mm) returns, and web depth as indicated on drawings; Series CSE.
   5. Size: 3 inch (76 mm) flange width, 1 inch (25.4 mm) returns, and web depth

as indicated on drawings; Series CSS.
6. Sizes: As indicated on drawings.
7. Minimum Yield Strength: 33 ksi (227 MPa) for 18 gauge and lighter.
8. Minimum Yield Strength: 50 ksi (345 MPa) for 16 gauge and heavier.
9. Minimum Yield Strength: As required for design.
10. Minimum Delivered Thickness: 20 gauge, 0.0329 inch (0.84 mm).
11. Minimum Delivered Thickness: 18 gauge, 0.0428 inch (1.09 mm).
12. Minimum Delivered Thickness: 16 gauge, 0.0538 inch (1.37 mm).
13. Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm).
14. Minimum Delivered Thickness: 12 gauge, 0.0966 inch (2.45 mm).

B. Runner Track: Cold formed galvanized steel sheet; by Dietrich Metal Framing
1. Designation: TSB Standard Leg 1-1/4 inches (32 mm) high.
2. Designation: Equal Leg.
3. Designation: Unequal Leg.
4. Designation: Custom size up to 3 inches (76.2 mm) high.
5. Minimum Yield Strength: 33 ksi (227 MPa) for 18 gauge and lighter.
6. Minimum Yield Strength: 50 ksi (345 MPa) for 16 gauge and heavier.
7. Minimum Yield Strength: As required for design.
8. Web Sizes: As required to match the system stud size.
9. Material thickness to match stud/joist thickness unless design dictates heavier thickness.

C. SLP-TRK Systems - Slotted Deflection Track by Brady Innovations, manufactured by Dietrich Metal Framing
1. Standard leg of 2-1/2 inches (63.5 mm).
2. Standard vertical slot of 1-1/2 inches (38.1 mm) in leg.
3. Thickness: 14 gage, 0.0677 inch (1.72 mm).
4. Thickness: 16 gage, 0.0538 inch (1.44 mm).
5. Thickness: 18 gage, 0.0428 inch (1.14 mm).
6. Thickness: 20 gage, 0.0329 inch (0.84 mm).
7. Product available with 2 1/2 drift slots in web 'special order.'
8. Minimum yield strength of 33 k.s.i. for 18 gauge and lighter.
9. Minimum yield strength of 50 k.s.i. for 16 gauge and heavier.

D. Deflection Clips:
1. Slide Clips: Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm).
2. Slide Clips: Minimum Delivered Thickness: 12 gauge, 0.0966 inch (2.45 mm).
3. Fast Top Clip: Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm)
4. Fast Strut Clip: Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm)
5. Fast ClipSlide Clip: Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm)
6. QuickClip: Minimum Delivered Thickness: 10 gauge, 0.1180 inch (3 mm)

E. Clip Angles (Support Clips) EasyClip Series:
1. Minimum Delivered Thickness: 16 gauge 0.0538 inch (1.37 mm)
2. Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm)
3. Minimum Delivered Thickness: 12 gauge, 0.0966 inch (2.45 mm).
4. EasyClip A Series
   a. Size: 3 by 3 by 3 inches (76.2 by 76.2 by 76.2 mm)
   b. Size: 3 by 3 by 6 inches (76.2 by 76.2 by 152 mm)

5. EasyClip U Series
   a. Size: 1-1/2 by 1-1/2 by 3-3/8 inches (38.1 by 38.1 by 85.7 mm)
   b. Size: 1-1/2 by 1-1/2 by 5-3/4 inches (38.1 by 38.1 by 146 mm)
   c. Size: 1-1/2 by 1-1/2 by 7-3/4 inches (38.1 by 38.1 by 197 mm)
   d. Size: 1-1/2 by 1-1/2 by 9-3/4 inches (38.1 by 38.1 by 248 mm)
6. EasyClip X Series
   a. Size: 2 by 2 by 3-3/8 inches (50.8 by 50.8 by 85.7 mm)
   b. Size; 2 by 2 by 5-3/4 inches (50.8 by 50.8 by 146.0 mm)
   c. Size: 2 by 2 by 7-3/4 inches (50.8 by 50.8 by 196.8 mm)
   d. Size: 2 by 2 by 9-3/4 inches (50.8 by 50.8 by 247.6 mm)
7. EasyClip S Series
   a. Size: 1-1/2 by 1-1/2 by 3 inches (38.1 by 38.1 by 76.2 mm)
   b. Size: 1-1/2 by 1-1/2 by 5 inches (38.1 by 38.1 by 127 mm)
   c. Size: 1-1/2 by 1-1/2 by 7 inches (38.1 by 38.1 by 178 mm)
   d. Size: 1-1/2 by 1-1/2 by 9 inches (38.1 by 38.1 by 229 mm)
   e. Size: 1-1/2 by 1-1/2 by 11 inches (38.1 by 38.1 by 279 mm)
8. EasyClip E Series
   a. Size: 4 by 1-1/2 by 3 inches (101 by 38.1 by 76.2 mm)
   b. Size: 4 by 1-1/2 by 5 inches (101 by 38.1 by 127 mm)
   c. Size: 4 by 1-1/2 by 7 inches (101 by 38.1 by 178 mm)
   d. Size: 4 by 1-1/2 by 9 inches (101 by 38.1 by 229 mm)
   e. Size: 4 by 1-1/2 by 11 inches (101 by 38.1 by 279 mm)

F. U-Channel:
1. Size: 3/4 inches (19.1 mm).
2. Size: 1-1/2 inches (38 mm).
3. Size: 2 inches (51 mm).
4. Length: Manufacturer's standard length.
5. Minimum Delivered Thickness: 16 gauge, 0.0538 inch (1.37 mm)

G. Bridging/Spacer Bar: Dietrich TradeReady Spazzer 5400 Bridging and Spacing Bar.
1. Minimum Delivered Thickness: 16 gauge, 0.0538 inch (1.37 mm).
2. 1-1/4 by 1-1/4 by 50 inches (32 by 32 by 1270 mm) long pre-notched at 12, 16 or 24 inches (406 by 610 mm) centers.
3. Dietrich TradeReady Spazzer Bar Guard: Minimum Delivered Thickness: 20 gauge, 0.0329 inch (0.84 mm)
4. Dietrich TradeReady Grommet.

H. Web Stiffeners:
1. Subject to compliance with requirements, provide Dietrich Metal Framing; EasyClip Quick Twist: Minimum Delivered Thickness: 12 gauge 0.0966 inch (2.45 mm)
2. Width: 4 inches (102 mm). Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm)
3. Length: As shown on drawings.

I. Floor Joists: Cold formed Galvanized Steel C-Joist, Dietrich TradeReady Floor System:
1. Size: 7-1/4 inches (184 mm) deep, with 1-3/4 inches (45 mm) flange, and 4-1/4 by 7 inches (108 by 178 mm) oval holes.
2. Size: 8 inches (203 mm) deep, with 1-3/4 inches (45 mm) flange, and 4-1/4 by 7 inches (108 by 178 mm) oval holes.
3. Size: 9-1/4 inches (235 mm) deep, with 1-3/4 inches (45 mm) flange, and 6-1/4 by 9 inches (159 by 229 mm) oval holes.
4. Size: 10 inches (254 mm) deep, with 2 inches (51 mm) flange and 6-1/4 by 9

inches (159 by 229 mm) oval holes.
5. Size: 11-1/4 inches (286 mm) deep, with 1-3/4 inches (45 mm) flange, and 6-1/4 by 9 inches (159 by 229 mm) oval holes.
6. Size: 12 inches (305 mm) deep, with 2 inches (51 mm) flange, and 8 inches (203 mm) diameter round holes.
7. Size: 14 inches (356 mm) deep, with 2 inches (51 mm) flange, and 10 inches (254 mm) diameter round holes.

J. Load-Bearing Headers:
1. Dietrich Metal Framing Heavy Duty Stud (HDS) and Header Bracket (HDSC) (Cold-formed galvanized one-piece load-bearing header).
   a. Size: 3-5/8 by 3 by 1-1/16 by 3/4 inches (92.1 by 76.2 by 27.0 by 19.1 mm).
   b. Size: 6 by 3 by 2-1/4 by 3/4 inches (152 by 76.2 by 57.2 by 19.1 mm)
   c. Size: 3-1/2 by 3-1/16 by 2 inches (88.9 by 77.8 by 50.8 mm)
   d. Size: 5-7/8 by 3-1/16 by 2 inches (149 by 77.8 by 50.8 mm)
   e. Minimum Delivered Thickness: [0.0329 (0.84 mm)] [0.0428 (1.09 mm)] [0.0538 (1.37 mm)] [0.0677 (1.72 mm)] [0.0966 (2.45 mm)] [Matching Steel Studs]
2. Dietrich TradeReady Load-Bearing Header (Cold-formed galvanized one-piece load-bearing header).
   a. Size: 3-7/8 inches (98 mm) wide with 8 inch (203 mm) legs.
   b. Size: 3-7/8 inches (98 mm) wide with 12 inch (305 mm) legs.
   c. Size: 6-1/4 inches (159 mm) wide with 8 inch (203 mm) legs.
   d. Size: 6-1/4 inches (159 mm) wide with 12 inch (305 mm) legs.
   e. Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm), minimum.
3. Brady Innovations ProX Header.

K. Framing Component Accessories: Provide the following accessories as required for a complete system.
1. Flat strapping.
2. Angles, plates, sheets.
3. Custom brake-formed shapes.

L. Fasteners: Self-drilling, self-tapping screws; Steel, complying with ASTM C1513; Galvanized coating, plated or oil-phosphate coated complying with ASTM B 633 as needed for required corrosion resistance.

M. Touch-Up Paint: Zinc rich, containing 95-percent metallic zinc, ZRC 350 as manufactured by ZRC Worldwide, Marshfield, MA.

2.3 MATERIALS

A. Cold-Formed Steel Sheet: Complying with ASTM A 1003/A 1003M; unless indicated otherwise.

B. Galvanized Coating: G60 coating weight minimum, complying with ASTM C 955.
1. Where required: G90 coating weight minimum, complying with ASTM C955.

2.4 FABRICATION

A. General: Framing components may be pre-assembled into panels prior to erecting.

B. Fabricate panels square, with components attached in a manner so as to prevent racking or distortion.

C. Cut all framing components squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Hold members positively in place until properly fastened.

D. Provide insulation as specified elsewhere in all double jamb studs and double header members, which will not be accessible to the insulation contractor.

E. Axially Loaded Studs:
1. Install studs to have full bearing against inside track web (1/8 inches (3.2 mm) maximum gap) prior to stud and track attachment.
2. Splices in axially loaded studs are not permitted.

F. Fasteners: Fasten components using self-tapping screws or welding.

G. Welding: Welding is permitted on 18 gauge or heavier material only.
1. Specify welding configuration and size on the Structural Calculation submittal.
2. Qualify welding operators in accordance with Section 6.0 of AWS D.1.3.
3. Touch up all welds with zinc-rich paint in compliance with ASTM A 780.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation, inspect previous work of all other trades. Verify that all work is complete and accurate to the point where this installation may properly proceed in strict accordance with framing shop drawings.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 ERECTION

A. General Erection Requirements:
1. Install cold-formed framing in accordance with requirements of ASTM C1007.
2. Weld in compliance with AWS D.1.3.
3. Install in compliance with applicable sections of the AISI's Standard for Cold-Formed Steel Framing General Provisions.

B. Wall Systems:
1. Erect framing and panels plumb, level and square in strict accordance with approved shop drawings.
2. Handle and lift prefabricated panels in a manner so as not to cause distortion in any member.
3. Anchor runner track securely to the supporting structure as shown on the erection drawings. Install concrete anchors only after full compressive strength has been achieved. Provide a sill sealer or gasket barrier between all concrete and steel connections.
4. Butt all track joints. Securely anchor abutting pieces of track to a common structural element, or butt-weld or splice them together.
5. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks except when vertical movement is specified.
6. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support, securely attached to supporting members.
7. Attach wall stud bridging in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations.

8. Frame wall openings to include headers and supporting studs as shown in the drawings.
9. Provide temporary bracing until erection is completed.
10. Provide stud walls at locations indicated on plans as "shear walls" for frame stability and lateral load resistance.
11. Where indicated in the drawings, provide for structural vertical movement using a vertical slide clip or other means in accordance with manufacturer's recommendations.

C. Steel Joists:
1. Locate joists directly over bearing studs within 3/4" or provide a suitable load distribution member at the top track.
2. Provide web stiffeners at reaction points where indicated in drawings.
3. Provide joist bridging as shown in drawings.
4. Provide end blocking where joist ends are not otherwise restrained from rotation.

3.3 FIELD QUALITY CONTROL

A. Inspection: Periodic special inspections are required by local code authorities.
1. Owner will hire and pay inspection agency.
2. Submit schedule showing when the following activities will be performed and resubmit schedule when timing changes.
3. Notify inspection agency not less than 3 days before the start of any of the following activities.
4. Inspections are required during welding operations, screw attachment, bolting, anchoring and other fastening of components within the force resisting structural system, including struts, braces, and hold-downs.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Loose bearing and leveling plates.
2. Loose steel lintels.
3. Shelf angles.

B. See Division 5 Section "Metal Stairs" for metal-framed stairs with metal pan, metal plate, or grating treads.

C. See Division 5 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

D. See Division 5 Section "Gratings" for metal gratings.

E. See Division 5 Section "Ornamental Metal" for ornamental metal items fabricated from custom components.

F. See Division 5 Section "Ornamental Handrails and Railings" for ornamental metal handrails and railings fabricated from stock components.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Grout.

B. Shop Drawings: Include plans, elevations, sections, details of installation, and attachments to other Work.

C. Templates: For anchor bolts.

D. Samples: For each type and finish of extruded nosing and tread.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:

1. Steel Shapes: ASTM A 992 Grade 50 ksi.
2. Steel Bars and Plates: ASTM A 36/A 36M
3. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
4. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
5. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
6. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
7. Slotted Channel Framing: Cold-formed metal channels 1-5/8 by 1-5/8 inches (41 by 41 mm) with flange edges returned toward web and with 9/16-inch- (14.3-mm-) wide slotted holes in webs at 2 inches (51 mm) o.c. Channels made from galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.
8. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664 and compatible with finish paint systems indicated.

B. Shop Primer for Ferrous Metal: SSPC-Paint 20, organic zinc-rich primer compatible with topcoat.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Company; Carboline 621.
b. PPG Industries, Inc.; Aquapon Zinc-Rich Primer 97-670.
c. Tnemec Company, Inc.; Tneme-Zinc 90-97.

C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls, of type, grade, and class required by application indicated.

B. Nonshrink, Nonmetallic Grout: ASTM C 1107, factory-packaged, nonstaining, noncorrosive, nongaseous grout.

C. Concrete Fill: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.4 FABRICATION

A. Connections, General: Use connections that maintain structural value of joined pieces.

1. Shear and punch metals cleanly and accurately. Remove burrs.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes.
4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

B. Loose Bearing and Leveling Plates: Fabricate loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

1. Galvanize plates after fabrication.

C. Loose Steel Lintels: Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

1. Galvanize loose steel lintels located in exterior walls.

D. Shelf Angles: Fabricate shelf angles of sizes indicated and for attachment to framing. Fabricate with horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c.

1. Galvanize shelf angles to be installed in exterior walls.
2. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.5 FINISHES

A. Finish metal fabrications after assembly. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Shop prime ferrous-metal items not indicated to be galvanized.

1. Hot-dip galvanize items indicated to be galvanized to comply with ASTM A 123 or ASTM A 153/A 153M as applicable.
2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
3. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Provide anchorage devices and fasteners for securing metal fabrications to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.

1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
2. Fit exposed connections accurately together. Weld connections, unless otherwise indicated. Do not weld, cut, or abrade galvanized surfaces.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack with nonshrink, nonmetallic grout.

C. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05520

METAL RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Provide pipe and tube handrails and railing systems.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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. Handrail and Railing Structural Performance: In accordance with applicable Building Code.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Railings:
1. Manufacturers, Handrails and Railings: Garfield Steel (970) 625-3551, Myers & Company Architectural Metals (970) 927-4761.
2. Application: Interior mezzanine level railing.
3. Steel Pipe and Tube Railing Systems:
   a. Steel Pipe, Black Finish: ASTM A 53.
4. Steel Finish: Primed.
5. Auxiliary Materials:
   a. Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79, compatible with topcoats.
   b. Galvanizing Repair Paint: SSPC - Paint 20.

PART 3 EXECUTION

3.1 INSTALLATION

A. Take field measurements prior to fabrication, where possible. Form to required shapes and sizes with true, straight edges, lines and angles. Provide light-tight, hairline joints.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

C. Coordinate with work of other sections; provide inserts and templates as needed. Install work plumb and level with uniform appearance.

D. Restore damaged finishes and protect work.

END OF SECTION

SECTION 05530

METAL GRATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Provide metal gratings, frames and supports.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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. Metal Bar Grating Standard: NAAMM MBG 531 "Metal Bar Grating Manual."

C. Heavy-Duty Metal Bar Grating Standard: NAAMM MBG 532 "Heavy Duty Metal Bar Grating Manual."

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Bar Gratings (at ornamental canopies – 7 locations):
1. Type: Refer to structural drawings for specifications.
2. Material: Shop primed steel, ASTM A 36.
3. Finish: Powder coated. Refer to architect for color.

PART 3 EXECUTION

3.1 INSTALLATION

A. Take field measurements prior to fabrication, where possible. Form to required shapes and sizes with true, straight edges, lines and angles.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

C. Coordinate with work of other sections; provide inserts and templates as needed. Install work plumb and level with uniform appearance.

D. Restore damaged finishes and protect work.

END OF SECTION

SECTION 06200

INTERIOR FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Provide interior finish carpentry.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

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. Standards: Architectural Woodwork Institute (AWI) 'Architectural Woodwork Quality Standards.'

C. Standards: Woodwork Institute of California (WIC) 'Manual of Millwork.'

D. Preservative Treatment: Nonpressure method, exterior type, AWPA N1

E. Fire-Retardant Treatment:
1. Lumber: AWPA C20, non-corrosive type.
2. Plywood: AWPA C27, non-corrosive type.
3. Particleboard: ASTM E 84, flame spread 20 or less.

F. Wood Products: Comply with the following:
1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

G. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship of each type of finish carpentry.

PART 2 PRODUCTS

2.1 MATERIALS

A. Interior Wood Casework:

1. Manufacturers: Open.
2. Species for Transparent Finish: As selected.
3. Species for Opaque Finish: As selected.
4. Grade: Custom.
5. Face Style: Flush.
6. Frame Fabrication: Frameless.
7. Grain Matching: Vertical.
8. Veneer Matching of Leaves: Book.
9. Veneer Matching In Panel Face: Running.

B. Interior Plastic Laminate Clad Casework:
1. Manufacturers: Open
2. Laminate: High pressure decorative laminate, NEMA LD-3.
3. Grade: Custom.
4. Face Style: Flush.
5. Frame Fabrication: Frameless.

C. Interior Casework Hardware and Auxiliary Materials:
1. Manufacturers: Open
2. Hardware Standard: ANSI/BHMA A156.9.
3. Hardware Finish and Base Metal: Brushed nickel.

D. Interior Plastic Laminate Clad Countertops:
1. Manufacturers: Open
2. Laminate: High pressure decorative laminate, NEMA LD-3.
3. Grade: Custom.
4. Core: Particleboard.
5. Edge: Laminate.

E. Interior Solid Surfacing Material Countertops:
1. Manufacturers: Open
2. Type: Homogeneous solid sheets ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.
3. Grade: Custom.
4. Edge: Decorative.

F. Interior Plywood Paneling:
1. Manufacturers: Open
2. Type: Hardwood veneer paneling, HPVA HP-1.
3. Species: Rotary cut natural birch veneer
4. Backing Veneer Species: Same species as face veneer.
5. Construction: Veneer core.
6. Face Pattern: Plain pattern.
7. Veneer Matching: Random.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide work to sizes, shapes, and profiles indicated. Install work to comply with quality standards referenced. Back prime work and install plumb, level and straight with tight joints; scribe work to fit.

B. Quality Standard: Install woodwork to comply with [AWI Section 1700] [WIC Section 26] for the same grade specified for type of woodwork involved.

C. Install materials and systems in accordance with manufacturer's instructions and

approved submittals. Install materials and systems in proper relation with adjacent construction. Use non-corrosive fasteners for exterior work. Coordinate with work of other sections.

D. Comply with manufacturer's requirements for cutting, handling, fastening and working treated materials.

E. Repair minor damage, clean and protect.

END OF SECTION

SECTION 07210

BUILDING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Provide thermal insulation and vapor retarders.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Submit for approval test reports.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Board Insulation:
1. Manufacturer: CertainTeed Corp., Insulation Group; Hunter Panels; Knauf Insulation. Refer to drawings for insulation board at the building retaining walls.
2. Application: Foundation walls.
3. Type: Extruded polystyrene, rigid.
a. Standard: ASTM C 578.

B. Blanket/Batt Insulation:
1. Manufacturer: Owens Corning.
2. Application: Thermal insulation in studs in exterior walls.
3. Application: Thermal insulation at underside of roofs, over heated spaces and soffits.
4. Application: Sound attenuation batts fiber glass at interior walls.
5. Type: Unfaced fiber glass.
a. Standard: ASTM C 665, Type I (unfaced).

C. Roof and Deck Insulation:
1. Manufacturer: Refer to drawings for manufacturer.
2. Application: Exterior roofs at Apparatus Bay.
3. Type: Polyisocyanurate.

D. Vapor Retarder (Not Integral with Insulation):
1. Manufacturer: InterWrap Inc.; Thermal Design.
2. Application: Exterior walls and insulated ceilings.
3. Type: Reinforced 2-ply polyethylene, 6 to 10 mils.
a. Accessories: Seam tapes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections. Provide full thickness in one layer over entire area, tightly fitting around penetrations.

B. Pour loose insulation into cavities indicated; provide uniform coverage at correct density and thickness.

C. Install vapor retarder over entire area of inside face of exterior walls and elsewhere as indicated. Seal all seams and around perimeter and penetrations with duct tape to form a continuous vapor retarder free of holes.

D. Protect installed insulation and vapor retarder.

END OF SECTION

SECTION 07411

METAL ROOF PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Provide manufactured roof panels.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

D. Warranty: Submit manufacturers standard warranty. Include labor and materials to repair or replace defective materials.
1. Warranty Period: 20 years.

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. Wind Uplift: Code required wind uplift resistance.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Roof Panels:
1. Manufacturers: MBCI, Berridge, or equivalent.
2. Type: Roll formed standing seam metal roof panel.
3. Panel Supports and Anchorage:
a. Roof Purlin: C or Z shaped sections, 16 gauge (.0598 inch) steel, shop painted.
b. Eave Struts: C shaped sections, 16 gauge (.0598 inch) steel, shop-painted.
c. Flange and Sag Bracing: 16 gauge (.0598 inch) steel, shop-painted.
d. Base and Sill Angles: 14 gauge (.0747 inch) galvanized steel.
e. Secondary Structural Members: 14 gauge (.0747 inch) galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged components and finishes. Clean and protect work from damage.

END OF SECTION

SECTION 07530

ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Provide elastomeric membrane roofing.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Warranty: Submit manufacturers standard warranty. Include labor and materials to repair or replace defective materials.
1. Warranty Period: 10 years.

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. Listing: UL Class A external fire exposure:

C. Listing: FM Class I construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. EPDM Membrane Roofing:
1. Manufacturers: Dow Roofing Systems, Stevens Roofing Systems, Firestone Building Product Company.
2. Type: Fully adhered.
3. Membrane: EPDM, 60 mils, non-reinforced.
a. Standard: ASTM D 4637, Type I.
4. Walkways: Walkway pads.
5. Cover Board over Insulation: Cementitious backer board, mechanically fastened.
6. Insulation: polyisocyanurate board insulation.
7. Insulation Profile: Refer to drawings (flat and tapered)
8. Insulation Substrate Board: Dens Deck cover board.
a. Standard: ASTM C 36, Type X.
9. Vapor Retarder: Reinforced polyethylene.

PART 3 EXECUTION

3.1 INSTALLATION

A. Inspect substrate and report unsatisfactory conditions in writing. Beginning work means acceptance of substrate.

B. Comply with roof system manufacturer's instructions and recommendations; clean, prime and prepare substrate.

C. Install insulation with tightly butted joints and neatly fitted around penetrations.

D. Begin roof installation only in presence of manufacturer's representative. Minimize seams and shingle overlaps to shed water.

E. Where applicable, distribute ballast uniformly to 10 pounds per square foot or more as required by FM. Obtain approval of ballast weight before loading roof.

F. Install walkway protection or pavers over an additional layer of membrane at locations indicated and where required to provide access to roof mounted equipment.

G. Restore or replace damaged components. Protect work from damage.

END OF SECTION

SECTION 07600

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 SUMMARY

A. Provide flashing and sheet metal.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Flashing and Sheet Metal:
   1. Application: Metal counterflashing and base flashing.
   2. Application: Exterior wall flashing and expansion joints.
   3. Application: Gutters and downspouts.
   4. Application: Exposed metal trim and fascia units.
   5. Application: Ridge and soffit vents.
   6. Metal: Pre-finished, 24 gauge extruded aluminum.
      a. Standard: 6063-T52, prefinished 2-coat 70% Fluoropolymer, 0.080 inches for primary legs of extrusion.
   7. Flexible Sheet Membrane Flashing: Nonreinforced flexible black elastic sheet, 50 to 65 mils thick, synthetic rubber.
   8. Laminated Composition Sheet Flashing: 5 ounce copper sheet laminated between 2 layers of bituminous impregnated Kraft paper or saturated fabric.
   9. Elastic Expansion Joints: Factory-fabricated metal-flanged edges to fit curbs and curb substrate.
   10. Soffit Vents: Continuous aluminum strip soffit vents
   11. Ridge Vents: Baffled ridge vent suitable for direct application of shingles.

B. Auxiliary Materials:
   1. Solder compatible with metal.
   2. Bituminous isolation coating.
   3. Mastic and elastomeric sealants.

4. Epoxy seam sealer.
5. Rosin-sized building paper slip sheet.
6. Polyethylene underlayment.
7. Reglets and metal accessories.
8. Gutter and conductor head guards.
9. Asphaltic roofing cement.

PART 3 EXECUTION

3.1 INSTALLATION

A. Follow recommendations of SMACNA Sheet Metal Manual. Allow for expansion. Isolate dissimilar materials.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Restore damaged components and finishes. Clean and protect work from damage.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

A. Provide joint sealers and fillers.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.
1. Include manufacturers full range of color and finish options if additional selection is required.

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. Field-Constructed Mock-Ups: Each joint type.

PART 2 PRODUCTS

2.1 MATERIALS

A. Exterior Joints in Vertical Surfaces:
1. Materials: Two component polysulfide: type I, class B nonsag.

B. Exterior Expansion Joints and Control Joints:
1. Materials: Equal to Tremco “Dymeric”.

C. Primer:
1. Materials: As recommended by caulking manufacturer.

D. Waterproof Sealants:
1. Materials: For joints in walls, slabs, etc. in shower rooms and toilet rooms, and other wet areas: Silicone sealant.

E. Interior Joints, Limited Movement, Acrylic:
1. Materials: Acrylic-emulsion, ASTM C 834.

F. Interior Joints, Sanitary Silicone:
1. Materials: One-part mildew-resistant silicone sealant, ASTM C 920.

PART 3 EXECUTION

3.1 INSTALLATION

A. Examine substrate; report unsatisfactory conditions in writing. Beginning work means acceptance of substrates.

B. Provide sealants in colors as selected from manufacturer's standards.

C. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections. Clean and prime joints, and install bond breakers, backer rods and sealant as recommended by manufacturers.

D. Depth shall equal width up to 1/2 inch wide; depth shall equal 1/2 width for joints over 1/2 inch wide.

E. Cure and protect sealants as directed by manufacturers. Replace or restore damaged sealants. Clean adjacent surfaces to remove spillage.

END OF SECTION

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Provide steel doors and frames.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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. Standards: ANSI/SDI-100, Recommended Specifications for Standard Steel Doors and Frames.

C. Performance Standards:
1. Fire-Rated Assemblies: NFPA 80, and acceptable testing agency listing.
2. Thermal-Rated Assemblies at Exterior: ASTM C 236 or ASTM C 976.
3. Sound-Rated Assemblies at Mechanical Rooms: ASTM E 1408, and ASTM E 413.

PART 2 PRODUCTS

2.1 MATERIALS

A. Exterior Steel Doors:
1. Material: Minimum 18 gauge galvanized steel sheet.
2. Door Thickness: 1-3/4 inches, thermally insulated.
3. Finish: Factory primed and field painted.
4. Accessories:
   a. Sightproof stationary louvers.
   b. Glazing stops.
   c. Silencers.

B. Exterior Steel Frames:
1. Material: Minimum 14 gauge galvanized steel sheet, fully grouted.
2. Corners: Mitered or coped.
3. Type: Knockdown.
4. Finish: Factory primed and field painted.

PART 3 EXECUTION

3.1 INSTALLATION

A. Fabricate work to be rigid, neat and free from seams, defects, dents, warp, buckle, and exposed fasteners. Install doors and frames in compliance with SDI-100, NFPA 80, and requirements of authorities having jurisdiction.

B. Provide thermally improved doors with maximum U-value of 0.24 BTU/hr./sq. ft. degree F (ASTM C 236) for all exterior doors and elsewhere as noted.

C. Provide acoustically improved doors with minimum STC of 33 (ASTM E 90 and ASTM E 413) where indicated.

D. Hardware: Prepare doors and frames to receive hardware on final schedule. Provide for 3 silencers on single doorframes; 2 on double doorframes.

E. Shop Finish: Clean, treat and prime paint all work with rust-inhibiting primer comparable with finish paint specified in Division 9 section. Provide asphalt emulsion sound deadening coating on concealed frame interiors.

F. Touch-up damaged coatings ready to receive finish painting.

END OF SECTION

SECTION 08210

WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Provide wood doors.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Warranty: Submit manufacturers standard warranty. Include labor and materials to repair or replace defective materials.
   1. Solid-Core Interior Doors: Life of installation.

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. Quality Standards for Stile and Rail Doors: NWWDA I.S. 6.

C. Quality Standards: NWWDA I.S.1-A, Architectural Wood Flush Doors.

D. Fire Rated Wood Doors: Refer to plans for rating, Meet NFPA 80 requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Interior Flush Wood Doors:
   1. Type: Solid core.
   2. Thickness: 1-3/4 inches thick.
   3. Grade: Custom.
   4. Frames: Hollow metal.
   5. Face: Birch – rotary natural.
   6. Finish: stain (provide architect with stain options).
   7. Finish Application: Factory finished.
   8. Auxiliary Materials:
      a. Glazed panels.
      b. Transom panels.
      c. Louvered panels.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NWMA I.S. 1A and specified quality standard.

B. Prefit doors to frames. Premachine doors for hardware listed on final schedules. Factory bevel doors.

C. Install doors with not more than 1/8 inch clearance at top and sides, 1/4 inch at bottom. Comply with NFPA 80 for rated assemblies.

D. Adjust, clean, and protect.

END OF SECTION

SECTION 08330

OVERHEAD COILING DOORS AND GRILLES

PART 1 GENERAL

1.1 SUMMARY

A. Provide overhead coiling doors and grilles.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Interior Overhead Coiling Grilles:
   1. Manufacturers: Overhead Door Corp. or equivalent.
   2. Grille Curtain and Finish: Aluminum, clear anodized.
      a. Standard: ASTM B 221.
   3. Operation: Manual.
   4. Mounting: Face of wall.
   5. Auxiliary Materials:
      a. Helical torsion spring counterbalance
      b. Hood for curtain and operating mechanism.
      c. Provision for padlocking.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Install assemblies complete with all hardware, anchors, inserts, supports and accessories. Test and adjust operation.

C. Install fire-rated doors to comply with NFPA 80.

D. Provide weatherstripping and windlocks for doors installed in exterior walls.

E. Restore damaged finishes and test for proper operation. Clean and protect work

from damage.

END OF SECTION

SECTION 08360

SECTIONAL OVERHEAD DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Provide sectional overhead doors.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sectional Overhead Doors:
1. Manufacturers: Overhead Door Corporation
2. Frame and Panels: Galvanized steel frame and steel insulated panels with partial glazing of steel panels.
3. Panel Profile: Flat.
4. Track Type: Standard track. High lift doors (maximize height of track – tight to structure above).
5. Operation: Electric door operator.
6. Service: Heavy commercial.
7. Steel Finish: Shop primed for site finish.
8. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel racers.
9. Lock: Interior mounted slide lock.
10. Weatherstripping: EPDM rubber bulb strip at bottom.
11. Electric Motor Operation: Door movement to be not less than 2/3 foot nor more than 1 foot per second.
12. Entrapment Protection: Electric sensing edge.
13. Operator Control: Push button operated control stations with open, close, and stop buttons for surface mounting for interior location (1/door). Hand held remote controller per door.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and

approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Install assemblies complete with all hardware, anchors, inserts, supports and accessories. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 08415

ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

A. Provide entrances and storefront.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Warranty: Submit manufacturer's standard warranty. Include labor and materials to repair or replace defective materials.
   1. Warranty Period: 5 years.

D. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, including operating instructions, list of spare parts and maintenance schedule.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum Entrances and Storefront:
   1. Manufacturers: EFCO Corporation, Kawneer.
   2. Aluminum Members: ASTM B 209, ASTM B 221, ASTM B 429.
   3. Steel Reinforcement: ASTM A 36, ASTM A 1008, and ASTM A 1011.
   4. Door Style: Medium stile and rail doors.
   5. Storefront Style: Aluminum framed, butt glazed vertical joints.
   6. Aluminum Finish: Color anodized.
   7. Auxiliary Materials:
      a. Push/pulls, doorstops, overhead holders, and deadlocks.
      b. Weatherstripping and thresholds.
      c. Exit devices.
      d. Electric-strike release.

PART 3 EXECUTION

3.1 INSTALLATION

A. Take field measurements before fabrication where possible; do not delay job progress.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Anchor securely in place; install plumb, level and in true alignment. Isolate dissimilar materials to prevent corrosion.

D. Coordinate with glass and glazing work; install hardware and adjust for smooth, proper operation.

E. Clean and protect completed system; repair damage.

END OF SECTION

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. Provide aluminum windows.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

D. Warranty: Submit manufacturer's standard warranty. Include labor and materials to repair or replace defective materials.
1. Warranty Period: 5 years.

E. Maintenance Data: Submit manufacturer's maintenance data, including maintenance schedule.

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. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship.

C. Performance: Comply with AAMA/NWWDA 101/I.S.2 for grade of window required.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum Windows:
1. Manufacturers: EFCO Corporation or equivalent.
2. Construction: Thermal-break type.
3. Aluminum Window Members: Aluminum extrusions.
4. Anchors, Clips, and Window Accessories: Aluminum, nonmagnetic stainless steel, or galvanized steel.
5. Window Operation: Refer to plans.
6. Grade: Commercial.
a. Standard: AAMA/NWWDA 101/I.S. 2, Grade 40.
7. Glazing: Insulating glass with low-e coating.
8. Glazing Color: Tinted glass.
9. Aluminum Finish: Baked enamel.

10. Screens: Provide at operable windows.

PART 3 EXECUTION

3.1 INSTALLATION

A. Fabricate windows to conform to AAMA standards and accept glass specified.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Operation: Provide locking units with manual operation; provide pole for out of reach hardware.

D. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.

1. Door hardware for steel (hollow metal) doors.
2. Door hardware for aluminum doors.
3. Door hardware for wood doors.
4. Door hardware for other doors indicated.
5. Keyed cylinders as indicated.

B. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

C. Allowances

1. Refer to Division 1 for allowance amount and procedures.

D. Alternates

1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

A. Comply with Division 1

1.3 SUBMITTALS:

A. Comply with Division 1

B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.

D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.

1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.
3. Manufacturer, product name, and catalog number.
4. Function, type, and style.
5. Size and finish of each item.
6. Mounting heights.
7. Explanation of abbreviations and symbols used within schedule.
8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

F. Samples: (If requested by the Architect)

1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.

1. Operating and maintenance manuals: Submit 3 sets containing the following.

a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Name, address, and phone number of local representative for each manufacturer.
d. Parts list for each product.

2. Copy of final hardware schedule, edited to reflect, "As installed".
3. Copy of final keying schedule
4. As installed “Wiring Diagrams” for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.

a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.

b. Hardware Schedule shall be prepared and signed by an AHC.

4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.

   a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
   b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.

6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

A. Refer to Conditions of the Contract

B. Manufacturer’s Warranty:

1. Closers: Ten years
2. Exit Devices: Three Years
3. Locksets & Cylinders: Three years
4. All other Hardware: Two years.

1.8 OWNER’S INSTRUCTION:

A. Instruct Owner’s personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.

1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

Item:	Manufacturer:	Approved:
Hinges	Stanley	Hager, McKinney
Continuous Hinges	Stanley	Select,Hager/Roton
Locksets & Cylinders	Best	Sargent,Schlage
Exit Devices	Precision	Von Duprin,Sargent
Pulls	Trimco	Rockwood
Closers	Stanley	Norton 7500,LCN 4040
Stops	Trimco	Rockwood
Overhead Stops	ABH	Glynn Johnson
Gasketing	Pemko	National Guard, Hager

2.2 MATERIALS:

A. Hinges:

1. Template screw hole locations
2. Minimum of 2 permanently lubricated non-detachable bearings
3. Equip with easily seated, non-rising pins
4. Sufficient size to allow 180-degree swing of door
5. Furnish hinges with five knuckles and flush [concealed] bearings
6. Provide hinge type as listed in schedule.
7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
9. UL10B listed for Fire

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10B listed for 3 hour Fire rating

4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Mortise Type Locks and Latches:

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C
2. Fit ANSI A115.1 door preparation
3. Functions and design as indicated in the hardware groups
4. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
5. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
6. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
7. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
8. Provide sufficient curved strike lip to protect door trim
9. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
10. Lock shall have self-aligning, thru-bolted trim
11. Levers to operate a roller bearing spindle hub mechanism
12. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
13. Spindle to be designed to prevent forced entry from attacking of lever
14. Provide locksets with 7-pin removable and interchangeable core cylinders
15. Each lever to have independent spring mechanism controlling it
16. Core face must be the same finish as the lockset
17. Provide tactile levers in areas of danger per ADA.

D. Exit Devices shall:

1. Tested and approved by BHMA for ANSI 156.3, Grade 1
2. Provide a deadlocking latchbolt
3. Non-fire rated exit devices shall have cylinder dogging.
4. Touchpad shall be “T” style
5. Exposed components shall be of architectural metals and finishes.
6. Lever design shall match lockset lever design
7. Provide strikes as required by application.
8. Fire exit devices to be listed for UL10C
9. UL listed for Accident Hazard
10. Provide vandal resistant or breakaway trim
11. Aluminum vertical rod assemblies are acceptable only when provide with the manufacturers optional top and bottom stainless steel rod guard protectors

E. Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.

F. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Closer shall have extra-duty arms and knuckles
4. Conform to ANSI 117.1
5. Maximum 2 7/16 inch case projection with non-ferrous cover
6. Separate adjusting valves for closing and latching speed, and backcheck
7. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
8. Full rack and pinion type closer with 1½“ minimum bore
9. Mount closers on non-public side of door, unless otherwise noted in specification
10. Closers shall be non-handed, non-sized and multi-sized 1 through 6

G. Kickplates: Provide with four beveled edges, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

H. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

I. Key Control: Provide one wall mounted key cabinet complete with hooks, index and tags model AWC-125-S by Telkee or equal.

J. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.3 FINISH:

A. Designations used in Schedule of Finish Hardware - 3.5, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

B. Cylinders, removable and interchangeable core system Best Standard 7 pin.

C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.

E. Furnish keys in the following quantities:

1. 1 each Grand Masterkeys

2. 4 each Masterkeys
3. 2 each Change keys each keyed core
4. 15 each Construction masterkeys
5. 1 each Control keys

F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.

1. Recommended Locations for Builder’s Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
2. NWWDA Industry Standard I.S.1.7, Hardware Locations for Wood Flush Doors.

3.3 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Conform to local governing agency security ordinance.

C. ADA Standard: Conform to ANSI A117.1 for positioning requirements for disabled.

D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.

1. Check and adjust closers to ensure proper operation.

a. Adjust closer to complete full closing cycle in less than 4 to 6 seconds without abrupt change of speed between "Sweep" and "Latch" speeds.
b. Adjust "Backcheck" according to manufacturer's instructions.
c. Set exterior doors closers to have 8.5 lbs maximum pressure to open, interior non-rated at 5 lbs, rated openings at 12 lbs

2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.

a. Verify levers are free from binding.
b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.

3. Report findings, in writing, to architect and hardware supplier outlining corrective actions and recommendations.

3.5 SCHEDULE OF FINISH HARDWARE:

A. Manufacturer's Abbreviations:

1. AB ARCHITECTURAL BUILDERS HARDWARE
2. BE BEST
3. DY DYNALOCK
4. HE HES
5. PE PEMKO
6. PR PRECISION
7. SD SECURITY DOOR CONTROLS
8. ST STANLEY
9. TR TRIMCO
10. VO VON DUPRIN

Hardware Sets

SET #1

2	Continuous Hinge	662HD	AL	ST
2	Push/Pull Set	1738	630	TR
2	Door Closer	D-4550 CS	AL	ST
2	Drop Plate	P45-180	AL	ST
1	Threshold	171 A MS&ES25		PE
2	Door Bottom	315 CN		PE

NOTE: BALANCE OF GASKETING PROVIDED BY ALUM DOOR SUPPLIER

SET #2

3	Hinges		FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Fire Exit Device		FL 2103 X 2003C SNB (2)	630	PR
1	Rim Cylinder		1E-72 STD R704	626	BE
1	Electric Strike	(2)	9500	630	HE
1	Power Supply	(14)	5025	GR	DY
1	Entry Check-Keypad	(1)	925		SD
1	Door Closer		D-4550 CS	AL	ST
1	Kickplate		KO050 10" X 2" LDW B3E CSK	630	TR
1	Threshold		171 A MS&ES25		PE
1	Weatherstrip		303AS @ Head & Jambs		PE
1	Door Bottom		315 CN		PE

(Refer to riser diagram for electro-mechanical layout as required)
NOTE: Operational Description:Authorized Keypad user unlocks electric Strike for entry.

SET #3

1	Continuous Hinge		662HD	AL	ST
1	Exit Device		2103 X 2003C SNB (2)	630	PR
1	Rim Cylinder		1E-72 STD R704	626	BE
1	Electric Strike	(2)	9500	630	HE
1	Power Supply	(14)	5025	GR	DY
1	Entry Check-Keypad	(1)	925		SD
1	Door Closer		D-4550 CS	AL	ST
1	Drop Plate		P45-180	AL	ST
1	Door Bottom		315 CN		PE
1	Threshold		171 A MS&ES25		PE

(Refer to riser diagram for electro-mechanical layout as required)
NOTE: : Operational Description:Authorized Keypad user unlocks electric Strike for entry.

SET #4

3	Hinges	FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset	45H-7D15H STD	630	BE
1	Door Closer	D-4550 CS	AL	ST
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Threshold	171 A MS&ES25		PE
1	Weatherstrip	303AS @ Head & Jambs		PE
1	Door Bottom	315 CN		PE

SET #5

NOTE: Overhead doors:Provide the proper Best rim or mortise cylinder to accommodate door suppliers lockset.

SET #100

1	Continuous Hinge		662HD	AL	ST
1	Continuous Hinge		662HD CUT FOR EPT	628	ST
1	Junction Box	(1)	JB-2R	2C	ST
1	Power Transfer	(7)	EPT 10	SP28	VO
1	Exit Device		2601 CD	630	PR
1	Electric Exit Device	(4)	ELR 2603 CD	630	PR
1	Power Supply	(14)	ELR151		PR
2	Door Pull		1191-4	630	TR
1	Entry Check-Keypad	(1)	925		SD
1	Rim Cylinder		1E-72 STD R704	626	BE
2	Mortise Cylinder		1E-74 STD R704	626	BE
2	Door Closer		D-4550 CS	AL	ST
2	Drop Plate		P45-180	AL	ST
1	Threshold		171 A 86" MS&ES25		PE

(Refer to riser diagram for electro-mechanical layout as required)

NOTE: : Operational Description:Authorized Keypad user unlocks electric Strike for entry.

SET #101

3	Hinges		FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Fire Exit Device		FL 2103 X 4903A SNB (2)	630	PR
1	Rim Cylinder		1E-72 STD R704	626	BE
1	Electric Strike	(2)	9500	630	HE
1	Power Supply	(14)	5025	GR	DY
1	Entry Check-Keypad	(1)	925		SD
1	Door Closer		D-4550 CS	AL	ST
1	Kickplate		KO050 10" X 2" LDW B3E CSK	630	TR
1	Smoke Seal		S88C X HSS2000		PE

(Refer to riser diagram for electro-mechanical layout as required)

NOTE: Note: Coordinate smoke seals with wood door supplier.
NOTE: : Operational Description:Authorized Keypad user unlocks electric Strike for entry.

SET #102

3	Hinges		FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset		45H-7D15H STD	630	BE
1	Electric Strike	(2)	7501	630	HE
1	Power Supply	(14)	5025	GR	DY
1	Entry Check-Keypad	(1)	925		SD
1	Door Closer		D-4551 STD SN	AL	ST
1	Kickplate		KO050 10" X 2" LDW B3E CSK	630	TR
1	Smoke Seal		S88C X HSS2000		PE

(Refer to riser diagram for electro-mechanical layout as required)

NOTE: : Operational Description:Authorized Keypad user unlocks electric Strike for entry.

SET #103

NOTE: Overhead Coiling Door: Provide the proper Best rim or mortise cylinder to accommodate door suppliers lockset

SET #104

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Privacy Set	45H-0L15H	630	BE
1	Door Closer	D-4551 STD SN	AL	ST
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Mop Plate	KM050 4" X 1" LDW X B3E X CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
3	Door Silencers	1229A		TR

SET #105

3	Hinges	FBB168 4 1/2 X 4 1/2	US26D	ST
1	Door Closer	D-4551 STD SN	AL	ST
1	Push Plate	1001-9	630	TR
1	Pull Plate	1015 6" X 16"	630	TR
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Mop Plate	KM050 4" X 1" LDW X B3E X CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
3	Door Silencers	1229A		TR

SET #106

3	Hinges	FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Fire Exit Device	FL 2108 X V4908A SNB (2)	630	PR
1	Rim Cylinder	1E-72 STD R704	626	BE
1	Door Closer	D-4551 EDA SN	AL	ST
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	S88C X HSS2000		PE

NOTE: Note: Coordinate smoke seals with wood door supplier.

SET #107

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Lockset	45H-7D15H STD	630	BE
1	Door Closer	D-4551 STD SN	AL	ST
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Mop Plate	KM050 4" X 1" LDW X B3E X CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	S88C X HSS2000		PE

NOTE: Note: Coordinate smoke seals with wood door supplier.

SET #108

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Lockset	45H-7D15H STD	630	BE
1	Door Closer	D-4551 STD SN	AL	ST
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	S88C X HSS2000		PE

NOTE: Note: Coordinate smoke seals with wood door supplier.

SET #109

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Passage Set	45H-0N15H	630	BE
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
3	Door Silencers	1229A		TR

SET #110

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Office Lockset	45H-7AB15H STD	630	BE
1	Door Closer	D-4551 STD SN	AL	ST
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
3	Door Silencers	1229A		TR

SET #111

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Classroom Lockset	45H-7R15H STD	630	BE
1	Door Closer	D-4551 STD SN	AL	ST
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
3	Door Silencers	1229A		TR

SET #112

3	Hinges	FBB168 4 1/2 X 4 1/2	US26D	ST
1	Classroom Lockset	45H-7R15H STD	630	BE
1	Door Closer	D-4551 EDA SN	AL	ST
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
3	Door Silencers	1229A		TR

SET #113

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Classroom Lockset	45H-7R15H STD	630	BE
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
3	Door Silencers	1229A		TR

SET #114

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Classroom Lockset	45H-7R15H STD	630	BE
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Overhead Stop	4421 SEX BOLTS	652	AB
3	Door Silencers	1229A		TR

SET #115

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Passage Set	45H-0N15H	630	BE
1	Kickplate	KO050 10" X 2" LDW B3E CSK	630	TR
1	Mop Plate	KM050 4" X 1" LDW X B3E X CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
3	Door Silencers	1229A		TR

Opening List

Hdw Set	Opening
100	2
101	111
103	112
104	109
105	109
106	109
107	109
108	113
109	109
110	109
111	113
112	109
113	109
114	105
115	105
116	115
117	115
118	107
119	106
122	101
123	110
124	110
125	110
126	108
127	4
129	111
131	104
132	104
133	111
134	1
194	3
196	3
100A	5
100B	5
100C	5
100D	5
100E	5
100F	5
100G	2
103A	113
125A	102
125B	114
129A	103
133A	113
134A	100

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 SUMMARY

A. Provide glass and glazing.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

D. Warranty: Submit manufacturer's standard warranty. Include labor and materials to repair or replace defective materials.
1. Laminated Glass: Manufacturer's 5-year warranty.
2. Coated Glass: Manufacturer's 10-year warranty.
3. Insulating Glass: Manufacturer's 10-year warranty.
4. Mirror Glass: Manufacturer's 5-year warranty.

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. Glazing for Fire-Rated Assemblies: Glazing for assemblies that comply with NFPA 80

C. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

D. Glazing Publications:
1. GANA Publications: GANA's 'Glazing Manual.' and 'Laminated Glass Design Guide.'
2. AAMA Publications: AAMA GDSG-1, 'Glass Design for Sloped Glazing,' and AAMA TIR-A7, 'Sloped Glazing Guidelines.'
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, 'Sloped Glazing Guidelines.'
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, 'Glazing Guidelines for Sealed Insulating Glass Units.'

E. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship.
1. Each type of glazing.

PART 2 PRODUCTS

2.1 MATERIALS

A. Glass and Glazing:
1. Type: High-performance insulating glass units with low-e coating, tempered at locations as required by code.
2. Auxiliary Materials:.
a. Compression gaskets.
b. Elastomeric glazing sealants.
c. Preformed glazing tapes.
d. Glazing gaskets.
e. Setting blocks, spacers, and compressible filler rods.
f. Mirror adhesive, top and bottom angles and clips.

PART 3 EXECUTION

3.1 INSTALLATION

A. Inspect framing and report unsatisfactory conditions in writing.

B. Comply with GANA "Glazing Manual" and manufacturers instructions and recommendations. Use manufacturer's recommended spacers, blocks, primers, sealers, gaskets and accessories.

C. Install glass with uniformity of pattern, draw, bow and roller marks.

D. Install sealants to provide complete wetting and bond and to create a substantial wash away from glass.

E. Set mirrors on stainless steel clips and adhere to wall with mirror adhesive.

F. Remove and replace damaged glass and glazing. Wash, polish and protect all glass supplied under this section.

END OF SECTION

SECTION 09260

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Provide gypsum board assemblies.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

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. Tolerances: Not more than 1/16-inch difference in true plane at joints between adjacent boards before finishing. After finishing, joints shall be not be visible. Not more than 1/8 inch in 10 feet deviation from true plane, plumb, level and proper relation to adjacent surfaces in finished work.

C. Fire Resistance for Fire-Rated Assemblies: ASTM E 119.

D. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship and level of finish.

E. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Gypsum Board:
   1. Material Standard: ASTM C1396.
   2. Type: Board for tape and joint compound finish.
      a. Type: Regular, moisture-resistant and fire-rated types as required.
      b. Typical Thickness: 5/8 inch and ½ inch (refer to drawings)
   3. Type: Water-resistant gypsum backing board.
      a. Type: Regular and fire-rated types as required:
      b. Typical Thickness: 5/8 inch.
   4. Joint Treatment: ASTM C474 and ASTM C840, 3-coat system, paper or fiberglass tape.
   5. Auxiliary Materials:
      a. Cornerbead, edge trim and control joints.
      b. Extruded aluminum reveals and channels.
      c. Gypsum board screws, ASTM C 1002.
      d. Gypsum board nails, ASTM C 514.
      e. Fastening adhesive.

f. Concealed acoustical sealant.
g. Mineral fiber sound attenuation blankets.
h. Mineral fiber thermal insulation.
i. Polyethylene vapor retarder, 6 mils.
j. Polystyrene aggregated finish for ceilings.
k. Acoustical finish.

B. Steel Framing for Interior Walls and Partitions (refer to structural drawings for exterior and load bearing steel framing):
1. Material Standard: ASTM C645.
2. Stud Thickness: 25 gauge
3. Stud Depth, Typical: 3-5/8 inches.
4. Stud Depth, Typical: 6 inches.
5. Furring Channel Thickness: 25 gauge (.0179 inch).
6. Auxiliary Framing Components: Furring brackets, resilient furring channels, Z-furring members, and non-corrosive fasteners.

PART 3 EXECUTION

3.1 INSTALLATION

A. Steel Framing: Install steel framing in compliance with ASTM C 754. Install with tolerances necessary to produce substrate for gypsum board assemblies with tolerances specified. Include blocking for items such as railings, grab bars, casework, toilet accessories, window treatment and similar items.

B. Wood Framing: Install wood framing in compliance with Section 06100 - Rough Carpentry. Install with tolerances necessary to produce substrate for gypsum board assemblies with tolerances specified. Include blocking for items such as railings, grab bars, casework, toilet accessories, window treatment and similar items.

C. Tape and Joint Compound: Install gypsum board for tape and 3-coat joint compound finish in compliance with ASTM C 840 and GA 216, Level 4 finish. Install gypsum board assemblies true, plumb, level and in proper relation to adjacent surfaces.

D. Veneer Plaster: Install gypsum board for veneer plaster finish in compliance with ASTM C 844. Install gypsum board assemblies true, plumb, level and in proper relation to adjacent surfaces.

E. Provide continuous vapor retarder at exterior walls.

F. Provide fire-rated systems where indicated and where required by authorities having jurisdiction.

G. Install boards vertically. Do not allow butt-to-butt joints and joints that do not fall over framing members.

H. Where new partitions meet existing construction, remove existing cornerbeads to provide a smooth transition.

I. Provide insulation full height and thickness in partitions at conference rooms, toilet rooms, between different occupancies, and where required.

J. Provide acoustical sealant at both faces at top and bottom runner tracks, wall perimeters, openings, expansion and control joints.

K. Install trim in strict compliance with manufacturer's instructions and

recommendations.

L. Repair surface defects. Leave ready for finish painting or wall treatment.

END OF SECTION

SECTION 09300

TILE

PART 1 GENERAL

1.1 SUMMARY

A. Provide tile.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.
1. Include manufacturers full range of color and finish options if additional selection is required.

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. Tile: ANSI A 137.1.

C. Tile Setting Materials: ANSI A 118 series standard specifications.

D. Tile Installation: ANSI 108 series standard specifications and Tile Council of America, Handbook for Ceramic Tile Installation.

E. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship.

PART 2 PRODUCTS

2.1 MATERIALS

A. Tile:
1. Application: Interior wall tile over tile backer board at wet areas.
2. Application: Interior floor tile over concrete slab.
3. Type: Ceramic mosaic tile.

B. Setting Materials:
1. Mortar setting bed.
a. Latex additive.
2. Thin-set mortar.
a. Dry-set Portland cement mortar.
b. Latex-Portland cement mortar.
c. Conductive dry-set mortar.
d. Chemical-resistant epoxy adhesive.
e. Chemical-resistant furan mortar.
f. Modified epoxy emulsion mortar.

3. Organic adhesive.
4. Grout.
   a. Sand-Portland cement grout.
   b. Dry-set grout.
   c. Latex-Portland cement grout.
   d. Chemical-resistant epoxy grout.
   e. Chemical-resistant furan resin grout.
   f. Silicone rubber elastomeric grout for pregrouted sheets.
5. Waterproofing membrane under tile.
   a. ANSI A 118.10.
6. Crack suppression membrane under tile.
   a. ANSI A 118.10.
7. Elastomeric sealants.
8. Stone thresholds.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with Tile Council of America and ANSI Standard Specifications for Installation for substrate and installation required. Comply with manufacturer's instructions and recommendations.

B. Install waterproof membrane in accordance with manufacturer's instructions and recommendations.

C. Lay tile in grid pattern with alignment grids. Layout tile to provide uniform joint widths and to minimize cutting; do not use less than 1/2 tile units.

D. Provide sealant joints where recommended by TCA and approved by Architect.

E. Grout and cure, clean and protect.

END OF SECTION

SECTION 09510

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Provide acoustical ceilings and suspension systems.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Extra Stock: Submit extra stock equal to 2 percent of amount installed.

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. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities. Acoustical performance based on project requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mineral Fiber Acoustical Ceilings:
   1. Panel Size: 24 by 48 inches.
   2. Panel Edge: Beveled.
   3. Grid: Concealed spline grid.
   4. Suspension System: Intermediate duty.
   5. Auxiliary Materials:
      a. Edge molding and trim.
      b. Hold-down clips and impact clips.
      c. Concealed acoustical sealant.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and suspension systems in accordance with manufacturer's instructions and recommendations, and ASTM C 636. Coordinate installation with location of mechanical and electrical work to ensure proper locations and anchorage.

B. Level ceiling to within 1/8 inch in 10 feet in both directions. Scribe and cut panels to

fit accurately. Measure and layout to avoid less than half panel units.

C. Removal and reinstallation at existing ceilings: Remove and store materials for reuse when allowed. Handle with white gloves and avoid damaging corners and edges. Clean tiles and grid system, which have been removed. Provide additional materials to complete the work and to replace damaged existing materials. New materials shall match existing materials as approved.

D. Adjust, clean, and touch-up all system components.

END OF SECTION

SECTION 09653

RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Provide resilient wall base and accessories.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Submit extra stock equal to 2% of total used.

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. Performance: Fire performance meeting requirements of building code and local authorities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Resilient Wall Base:
1. Manufacturers: Roppe, Johnsonite, Burke or equivalent.
2. Standard: ASTM F 1861.
3. Type: TS (rubber, vulcanized thermoset).
4. Group: I (solid, homogeneous)
5. Style: Cove.
6. Thickness: 0.125 inch
7. Height: 4 inches.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions and recommendations. Install in proper relation to adjacent work.

B. Install base and accessories to minimize joints. Install base with joints as far from corners as practical.

C. Clean, polish, and protect.

END OF SECTION

SECTION 09670

FLUID AND TROWEL-APPLIED FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Provide fluid-applied flooring and floor preparation.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fluid Applied Flooring:
   1. Manufacturers: Ashford Formula Sealer (Apparatus Bay),
   2. Type: Cure-Seal-Hardener. Ashford Formula; water-based chemically-reactive penetrating sealer and hardener
   3. Surface: Standard surface.
   4. Auxiliary Materials: Per manufacturers recommendations.
   5. Manufacturer: HTC SuperFloor (at all stained floor locations – refer to finish schedule on drawings).

PART 3 EXECUTION

3.1 INSTALLATION

A. Prepare surfaces and install materials and systems in accordance with manufacturer's instructions and approved submittals.

B. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Restore damaged finishes. Clean and protect work from damage.

END OF SECTION

SECTION 09680

CARPET

PART 1 GENERAL

1.1 SUMMARY

A. Provide sheet carpet and floor preparation.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Seaming Layout: Submit proposed seaming layout.

D. Extra Stock: Submit extra stock equal to 2% of total used.

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. Performance: Fire performance meeting requirements of building code and local authorities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Carpet Material (28 oz minimum):

B. Manufacturer: Shaw (Curtain Call product line)
   1. Installation Method: Direct glue down.
   2. Auxiliary Materials:
      a. Edge guards.
      b. Adhesives, cements and fasteners.
      c. Leveling compound.

C. Carpet Pad (at all carpet locations):
   1. Type: Rubber.
   2. Service: Heavy traffic.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with recommendations of Carpet and Rug Institute 'Specifier's Handbook'.

B. Prepare surfaces and install materials in accordance with manufacturer's instructions and approved submittals. Clean, patch, and level substrate. Install materials in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Install edge guards and reducer strips as required; clean and protect.

END OF SECTION

SECTION 09720

WALL COVERING

PART 1 GENERAL

1.1 SUMMARY

A. Provide wall coverings and surface preparation.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Extra Stock: Submit extra stock equal to 2 unopened rolls of each type of wall covering used.

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. Performance: Fire performance meeting requirements of building code and local authorities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Decorative Metal Wall Panels (diamond plate):
1. Material and Finish: Aluminum sheet with anodized finish and black powder coated (refer to plans for locations). Refer to plans for thickness
2. Material and Finish: Perforated aluminum sheets (refer to plans for location, thickness and perforation size)
3. Material and Finish: Stainless steel trim (refer to plans for size and thickness)

PART 3 EXECUTION

3.1 INSTALLATION

A. Acclimatize materials; prime and seal substrates; test substrates for moisture content and prepare surfaces in compliance with manufacturer's recommendations.

B. Install in accordance with manufacturer's instructions. Apply adhesive and install with seams plumb and overlapped and double-cut to ensure tight closure except where pattern would not match. Do not place seams within 6" of corners.

C. Remove air bubbles, blisters, wrinkles and other defects; horizontal seams are not

permitted. Remove excess adhesive immediately; clean walls and protect surfaces.

END OF SECTION

SECTION 09910

PAINTS

PART 1 GENERAL

1.1 SUMMARY

A. Provide painting and surface preparation.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.
   1. Include manufacturers full range of color and finish options if additional selection is required.

C. Extra Stock: Submit 2 unopened gallons of each paint and color used in the project.

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. Regulations: Compliance with VOC and environmental regulations.

C. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship.
   1. Provide 4 foot x 4 foot mock-ups of each type of surface.

PART 2 PRODUCTS

2.1 MATERIALS

A. Painting:
   1. Manufacturers: Benjamin Moore & Co.; Duron Paints & Wallcoverings; Kelly-Moore Paints; Miller Paint Co. / Devine Color; PPG Architectural Finishes, Inc. - Pittsburgh Paints; Pratt & Lambert Paints; Sherwin-Williams; Zinsser / Rust-Oleum Consumer Brand Group.
   2. Application: Interior and exterior unfinished surfaces.
   3. Application: Exposed mechanical and electrical items.
   4. Primary Coating Type: Latex based paints.
   5. Primary Paint Systems: Primer plus two finish coats.

PART 3 EXECUTION

3.1 INSTALLATION

A. Inspect surfaces, report unsatisfactory conditions in writing; beginning work means acceptance of substrate.

B. Comply with manufacturer's instructions and recommendations for preparation, priming and coating work. Coordinate with work of other sections.

C. At existing areas to be repainted, remove blistered or peeling paint to sound substrates. Remove chalk deposits and mildew and wash all surfaces with mild detergent. Perform related minor preparation including caulk and glazing compounds. Spot prime bare areas before priming and painting as specified.

D. Match approved mock-ups for color, texture, and pattern. Re-coat or remove and replace work which does not match or shows loss of adhesion. Clean up, touch up and protect work.

3.2 PAINT SCHEDULE

A. Gypsum Drywall Walls:
   1. Gloss:
      a. Semi
   2. System:
      a. Primer coat
      b. Intermediate coat
      c. Top coat

B. Gypsum Drywall Walls and Ceilings in Bathrooms, Kitchens and Wet Areas:
   1. Gloss:
      a. Semi
   2. Texture:
      a. Level 4
   3. System:
      a. Primer coat
      b. Intermediate coat
      c. Top coat

C. Gypsum Drywall Walls, Multicolor Finish:
   1. System:
      a. Primer coat
      b. Top coat

D. Gypsum Drywall Walls to Receive Wall Covering:
   1. System:
      a. Primer coat

E. Gypsum Drywall Ceilings:
   1. Gloss:
      a. Semi
   2. System:
      a. Primer coat
      b. Intermediate coat
      c. Top coat

F. Plaster:
   1. Gloss:
      a. Semi
   2. System:
      a. Primer Coat
      b. Intermediate Coat
      c. Top coat

G. Wood for Painted Finish:
1. Gloss:
   a. Semi
2. System:
   a. Primer coat
   b. Intermediate coat
   c. Top coat

H. Wood for Transparent Finish:
1. Gloss:
   a. Satin
2. System:
   a. Sand and seal coat
   b. Finish coat

I. Wood for Stain Finish:
1. Gloss:
   a. Satin
2. System:
   a. Stain coat
   b. Sand and seal coat
   c. Finish coat

J. Exterior Wood for Stain Finish:
1. System:
   a. Primer coat
   b. Intermediate coat
   c. Top coat

K. Exterior Wood for Painted Finish:
1. Gloss:
   a. Semi
2. System:
   a. Primer coat
   b. Intermediate coat
   c. Top coat

L. Concrete Masonry Units:
1. Gloss:
   a. Semi
2. System:
   a. Primer coat
   b. Intermediate coat
   c. Top coat

M. Concrete Walls:
1. Gloss:
   a. Semi
2. System:
   a. Primer coat
   b. Intermediate coat
   c. Top coat

N. Ferrous Metals:
1. Gloss:
   a. Semi
2. System:

a. Primer coat
b. Intermediate coat
c. Top coat

O. Galvanized Metal:
1. Gloss:
a. Semi
2. System:
a. Primer coat
b. Intermediate coat
c. Top coat

END OF SECTION

SECTION 10100

VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Provide visual display boards.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Markerboards:
1. Manufacturers: Claridge Product, Lemco
2. Materials: Porcelain enamel face for liquid-type markers, core material, and backing.
3. Operation: Fixed.
4. Trim: Metal frame and tray, anodized or powder coated finish.
5. Include map rail. Refer to drawings for markerboard sizes.

B. Tackboards:
1. Manufacturers: Claridge Products, Information Display Technologies, Lemco
2. Materials: Natural cork.
3. Operation: Fixed.
4. Trim: Metal frame and tray, anodized or powder coated finish.
5. Refer to drawings for tackboard size

PART 3 EXECUTION

3.1 INSTALLATION

A. Take field measurements before fabrication where possible; do not delay progress.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Tolerances: 1/16" in 20' from true plumb, level and alignment. Limit flush variation

between adjacent panels to 1/16". Provide tight and closed gaps between panels unless detailed otherwise.

D. Restore damaged finishes. Clean and protect work from damage.

END OF SECTION

SECTION 10150

TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Provide toilet partitions and screens.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Toilet Compartments:
   1. Manufacturers: American Sanitary Partition Corp.; General Partitions Mfg. Corp.; Global Partitions; Hadrian Inc.; Scranton Products;
   2. Compartments: Floor and ceiling supported.
   3. Style: Standard privacy style.
   4. Material: Solid phenolic.
      a. High-pressure melamine surface fused to solid phenolic core.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Limit openings between panels, doors and pilasters to less than 1/2".

C. Adjust hardware, clean, and protect work.

END OF SECTION

SECTION 10195

CUBICLES

PART 1 GENERAL

1.1 SUMMARY

A. Provide cubicle curtains and tracks.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cubicle Curtains and Tracks (at sleeping quarters restrooms):
1. Material: Extruded aluminum with clear anodized finish.
2. Curtain Carriers: Suitable for fabric.
3. Track Attachment: Suitable for substrate.
4. Curtain Fabric: Flame retardant polyester.
5. Curtain Pattern: Decorative.

PART 3 EXECUTION

3.1 INSTALLATION

A. Take field measurements prior to fabrication, where possible. Form to required shapes and sizes with true, straight edges, lines and angles.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

C. Test for proper operation. Restore damaged finishes and protect work.

END OF SECTION

SECTION 10260

WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 SUMMARY

A. Provide wall corner and door protection systems.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

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. Performance: Fire performance meeting code requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Corner Guards:
1. Manufacturers: AFCO USA, Acrovyn.
2. Type: Stainless steel corner guards, surface mounted – 4’ tall.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials in accordance with manufacturer's instructions and approved submittals. Install materials in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged finishes. Clean and protect work from damage.

END OF SECTION

SECTION 10350

FLAGPOLES

PART 1 GENERAL

1.1 SUMMARY

A. Provide flagpole systems.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
1. Shop drawings shall be prepared and stamped by a qualified engineer licensed in the jurisdiction of the project.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Flagpoles:
1. Manufacturers: Admiral Flag Poles or equivalent.
2. Shape: Cone tapered.
3. Type: Vertical pole, internal halyard.
4. Mounting: Ground-set.
5. Material and Finish: Aluminum with color anodized finish.
6. Accessories:
a. Internal halyard.
b. Halyard/cleat cover.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 10430

SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Provide signage.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Interior Building Plaque,
1. Manufacturers: OMC Industries, Inc., Gemini Signs or equivalent.
2. Size: Refer to drawings.
3. Metal: Aluminum.
4. Background texture: Pebble.
5. Plaque finish: Aluminum.
6. Mounting: Solid wall mount.

Refer to drawings for exterior aluminum signage (north elevation).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged finishes. Clean and protect work from damage.

END OF SECTION

SECTION 10520

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Provide fire extinguishers, cabinets and accessories.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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. Standards: UL and FM listed products, NFPA 10.

C. Regulations: ADAAG.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fire Extinguishers:
1. Manufacturers: JL Industries, Larsen Manufacturing Co.
2. Type: Multipurpose dry chemical type.
3. Rating: Sized for project requirements.
4. Public Area Mounting: Cabinet mounted.
5. Service Area Mounting: Metal brackets.

B. Cabinets:
1. Manufacturers: JL Industries, Larsen Manufacturing Co.
2. Mounting: Recessed.
3. Mounting: Semi-recessed.
4. Mounting: Surface-mounted.
5. Trim: Trimless with hidden flange.
6. Doors: Aluminum, color anodized finish.
7. Door Style: Duo-panel.
8. Accessories:
   a. Glass breaker or fire handle.
   b. Signage.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Install fire extinguishers in mechanical and service areas with wall-hung brackets at locations and heights indicated and acceptable to authorities having jurisdiction.

C. Install fire extinguishers in cabinets in public areas plumb and level at heights acceptable to authorities having jurisdiction.

D. Restore damaged finishes. Clean and protect work from damage.

END OF SECTION

SECTION 10800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Provide toilet, bath and laundry accessories.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Toilet and Bath Accessories:
1. Manufacturers: Bobrick, Bradley Corp., A&J Washroom Accessories Inc.
2. Accessory: Toilet tissue dispensers, single roll.
3. Accessory: Combination towel dispenser/waste receptacle units.
4. Accessory: Grab bars.
5. Accessory: Soap dispensers, counter mounted.
6. Accessory: Grab bars.
7. Accessory: Sanitary napkin disposal.
8. Accessory: Towel bars.
9. Accessory: Mop and broom holders.
10. Accessory: Robe hooks.
11. Accessory: Toilet paper holder.
12. Accessory: Framed glass shower door with 5/32” tempered glass, continuous piano hinge and hardware, gutter at bottom of door, silver aluminum finish on frame and hardware.
13. Finish: Stainless steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 12490

WINDOW TREATMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Provide window treatments.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Vertical Louver Blinds:
1. Manufacturers: Hunter Douglas or equivalent
2. Track Materials: Extruded aluminum channel or roll-formed steel.
3. Blind Type: Traversing.
4. Track Type: Head track only.
5. Louver Blades: Fabric, 3-1/2 inch width.
6. Louver Blade Type: Solid.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 13851

FIRE ALARM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.

1.2 Related Sections:

1. Section 13930 - Wet-Pipe Fire Suppression Sprinklers: Flow detection and alarm devices.
2. Section 16060 - Grounding and Bonding for Electrical Systems.
3. Section 16077 - Identification for Electronic Safety and Security.
4. Section 16123 - Building Wire and Cable.

1.3 REFERENCES

A. National Fire Protection Association:
1. NFPA 72 - National Fire Alarm Code.

1.4 SYSTEM DESCRIPTION

A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to municipal system. with connections to central station.

B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
1. Local fire alarm signaling devices sound and display with signal.
2. Non-coded signal transmits to central station.
3. Location of alarm zone indicates on fire alarm control panel and on remote annunciator panel.
4. Signal transmits to release door hold-open devices.
5. Signal releases electric door locks.

C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.

D. Trouble Sequence of Operation: System or circuit trouble causes the following

system operations:

1. Visual and audible trouble alarm indicates by zone at fire alarm control panel.
2. Visual and audible trouble alarm indicates at remote annunciator panel.
3. Trouble signal transmits to central station.

E. Zoning: As indicated on Drawings.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures:

B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout, and.

C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.

D. Test Reports: Indicate procedures and results for specified field testing and inspection.

E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.6 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of fire alarm equipment.

C. Operation and Maintenance Data: Submit manufacturer’s standard operating and maintenance instructions.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Perform Work in accordance with NFPA standards.

C. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience, and with service facilities within 100 miles of project.

B. Installer: Certified fire alarm installer with service facilities within 100 miles of Project.

1.9 MAINTENANCE SERVICE

A. Section 01700 - Execution Requirements: Maintenance service.

B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.10 MAINTENANCE MATERIALS

A. Section 01700 - Execution Requirements: Spare parts and maintenance products.

B. Furnish ten manual station break-glass rods.

C. Furnish six keys of each type.

1.11 EXTRA MATERIALS

A. Section 01700 - Execution Requirements: Spare parts and maintenance products.

B. Furnish three of each type of automatic smoke detector without base.

PART 2 PRODUCTS

2.1 CONTROL PANEL

A. Manufacturers:
1. Notifier Model AFP 200.
2. Substitutions: Engineer Approved

B. Product Description: Modular fire alarm control panel with surface wall-mounted enclosure.

C. Power supply: Adequate to serve control panel modules, remote detectors,

remote annunciators, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.

D. System Supervision: Component or power supply failure places system in trouble mode.

E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from initiating alarm.

F. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from signaling alarm.

G. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.

H. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.

2.2 MANUAL FIRE ALARM STATIONS

A. Manufacturers:
1. Notifier.
2. Substitutions: Engineer Approved

B. Product Description: Manual double-action station with break-glass rod.

C. Mounting: Semi-Flush.

D. Type: Non-coded.

E. Backbox: Manufacturer's standard.

2.3 CEILING SMOKE DETECTOR

A. Manufacturers:
1. Notifier Model.
2. Substitutions: Engineer Approved

B. Product Description: NFPA 72, photoelectric type ceiling smoke detector with

the following features:
1. Adjustable sensitivity.
2. Plug-in base.
3. Auxiliary relay contact.
4. Integral thermal element rated 135 degrees F.
5. Visual indication of detector actuation.

C. Mounting: 4 inch outlet box.

D. Furnish four-wire detector with separate power supply and signal circuits.

2.4 DUCT-MOUNTED SMOKE DETECTOR

A. Manufacturers:
1. Notifier Model.
2. Substitutions: Engineer Approved

B. Product Description: NFPA 72, photoelectric type with the following features:
1. Auxiliary SPDT relay contact.
2. Key-operated normal-reset-test switch.
3. Duct sampling tubes extending width of duct.
4. Visual indication of detector actuation.
5. Duct-mounted housing.

C. Furnish four-wire detector with separate power supply and signal circuits.

2.5 ALARM LIGHTS

A. Manufacturers:
1. Wheelock
2. Substitutions: Engineer Approved

B. Product Description: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens.

2.6 ALARM HORN

A. Manufacturers:
1. Wheelock
2. Substitutions: Engineer Approved

B. Product Description: NFPA 72, flush type fire alarm horn with the following features:

1. Sound Rating: 87 dB at 10 feet.
2. Integral strobe lamp and flasher with red lettered "FIRE" on white lens.

C. Product Description: Exterior mounted horn with the following features:
1. Sound Rating: 96 dB at 10 feet.

2.7 REMOTE ANNUNCIATOR

A. Manufacturers:
1. Notifier LCD 80.
2. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble.

C. Mounting: Factory mounted in flush wall-mounted enclosure.

2.8 DOOR RELEASE

A. Manufacturers:
1. Model.
2. Substitutions: Section 01600 - Product Requirements.

B. Product Description: Magnetic door holder with integral diodes to reduce buzzing.

C. Coil voltage: 24 VDC

2.9 WIRE AND CABLE

A. Product Description: Power limited fire-protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C.

B. Cable Located Exposed in Plenums: Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

C. Fire alarm circuit conductors have insulation color or code as follows:
1. Power Branch Circuit Conductors: Black, red, white.
2. Initiating Device Circuit: Black, red.
3. Detector Power Supply: Violet, brown.

4. Signal Device Circuit: Blue (positive), white (negative).
5. Door Release: Gray, gray.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify products and systems receiving devices are ready for installation.

3.2 INSTALLATION

A. Install manual station with operating handle 4 feet 6 inches feet above floor.

B. Install audible and visual signal devices 7 feet 6 inches feet above floor.

C. Install 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors in cable.

D. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.

F. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors.

G. Automatic Detector Installation: Conform to NFPA 72.

H. Install engraved plastic nameplates in accordance with Section 16077.

I. Ground and bond fire alarm equipment and circuits in accordance with Section 16060.

3.3 FIELD QUALITY CONTROL

A. Section:Field inspecting, testing, adjusting, and balancing.

B. Test in accordance with NFPA 72 and local fire department requirements.

3.4 MANUFACTURER'S FIELD SERVICES

A. Section 01400 - Quality Requirements: Manufacturer’s field services.

B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.5 DEMONSTRATION AND TRAINING

A. Furnish 1 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION

SECTION 13900

FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes complete fire suppression system including sprinkler system, standpipe system, and fire department connections.

1.2 SYSTEM DESCRIPTION

A. Sprinkler System: Conform to the following criteria:
   1. Coverage for entire building.
   2. Design system hydraulically to NFPA 13.
   3. System performance to achieve Light Hazard occupancy requirements in all areas of the building except the apparatus bay which will be designed to Ordinary Hazard Group 2.

1.3 SUBMITTALS

A. Shop Drawings: Indicate detailed fire pump and jockey pump layout, pipe layout, supports, components, accessories, sizes, and hydraulic calculations.

B. Product Data: Submit data for pipe materials used, valves, manufacturer's catalog sheet for equipment indicating rough-in size, finish, accessories, pump type, capacity, power requirements, certified pump curves, and NPSH.

C. Samples: Submit two sprinklers of each type specified.

D. Manufacturer's Certificate: Certify system has been tested and meets or exceeds specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of sprinkler heads.

B. Operation and Maintenance Data: Submit description of components of system, servicing requirements, record drawings, inspection data, and parts lists.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with:
   1. Sprinkler Systems: NFPA 13.

B. Maintain one copy of each document on site.

C. Design fire suppression system under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Colorado.

PART 2 PRODUCTS

2.1 PIPE AND TUBE

A. Steel Pipe: ASTM A53/A53M, Grade B, ASTM A135, or ASME B36.10M, Schedule 10 or 40 black.
   1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
   2. Cast Iron Fittings: ASME B16.1, flanges and fittings; ASME B16.4, threaded fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded type; ASTM A47/A47M.
   4. Mechanical Grooved Couplings: Malleable iron housing, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

B. Steel Pipe: ASTM A53/A53M, Grade B, ASTM A135, or ASTM A795 Schedule 5 black.
   1. Steel Fittings: Cold drawn steel, mechanically attached, with butylene or EPDM O-ring.

C. Steel Pipe: ASTM A135 Grade A, ULC threadable thin wall, black.
   1. Cast Iron Fittings: ASME B16.1, flanges and fittings; ASME B16.4, threaded fittings.
   2. Malleable Iron Fittings: ASME B16.3 threaded type. ASTM A47/A47M.

D. Copper Tubing: ASTM B75, ASTM B88, or ASTM B251, Type M or L hard drawn.
   1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze, solder joint, pressure type.
   2. Joints: AWS A5.8, silver braze.
   3. Mechanical Grooved Couplings: Ductile iron housing with alkyd enamel paint coating clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.

2.2 GATE VALVES

A. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.

B. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.

2.3 BUTTERFLY VALVES

A. Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper switch.

B. Iron body, iron or bronze disc, EPDM seat, wafer, lug, or grooved ends, extended neck, hand wheel and gear drive, integral indicating device, and external tamper switch.

2.4 CHECK VALVES

A. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.

C. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal and threaded, wafer or flanged ends.

2.5 DRAIN VALVES

A. Bronze compression stop with hose thread nipple and cap.

B. Brass ball valve with cap and chain, 3/4 inch hose thread.

2.6 SPRINKLERS

A. Manufacturers:
   1. Viking Model.
   2. Central Model.
   3. Model.
   4. Substitutions: Permitted.

B. Suspended Ceiling Type: Concealed pendant type with chrome plated finish, and matching escutcheon.

C. Exposed Area Type: Standard upright type with chrome plated finish.

D. Sidewall Type: Standard horizontal sidewall type chrome plated finish with matching escutcheon.

E. Guards: Finish to match sprinkler head.

2.7 SPRINKLER PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with electrically or hydraulically operated alarms, with pressure retard chamber and variable pressure trim.

B. Water Motor Alarm: Hydraulically operated impeller type alarm gong, red enameled.

C. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.

D. Water Flow Switch: Vane type switch with two contacts.

2.8 FIRE DEPARTMENT CONNECTION

A. Type: Flush mounted wall type with brass finish.

B. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.

C. Drain: 3/4 inch automatic drip, to outside.

D. Label: "Sprinkler - Fire Department."

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance NFPA 13.

B. Ream pipe and tube ends to full inside diameter. Remove burrs and bevel plain end ferrous pipe.

C. Remove scale and foreign material, inside and outside, before assembly.

D. Install sleeves where penetrating footings, floors, or walls. Seal pipe and sleeve penetration to maintain fire resistance equivalent to fire separation of footings, floors, or walls.

E. Install pipe runs to minimize obstruction to other work. Offset around ductwork.

F. Install piping in concealed spaces above finished ceilings.

G. Install butterfly valves for shut-off or isolating service.

H. Install drain valves at main shut-off valves, low points of piping and apparatus.

I. Connect system to water source ahead of domestic water connection with double check valve assembly.

J. Install heads to coordinate with reflected ceiling plan. Center in one direction in ceiling tiles.

K. Protection:
   1. Apply temporary tape or paper cover to sprinkler heads to protect from painting.

2. Protect concealed sprinkler head cover plates from painting.

L. Install drain piping from tank to nearest floor drain.

M. Interface sprinkler system with building fire and smoke alarm system.

N. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

O. Flush entire piping system of foreign matter.

P. Hydrostatically test entire system. Schedule test to be witnessed by Fire Marshall.

END OF SECTION

SECTION 15050

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittals and substitutions
2. Identification for Plumbing Piping and Equipment.
3. Sleeves.
4. Mechanical sleeve seals.
5. Formed steel channel.

1.2 SUBMITTALS

A. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

B. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

C. Product Data: Submit for mechanical approval the manufacturers catalog literature for each product required. Submit information showing capacities, dimensions and installation and operating procedures. Submittal information shall be bound in clearly identified 3-ring binders that are indexed and tabbed for the project. Number of submittals shall be as required in the General Conditions section 1300 or a minimum of five (5) copies.

D. Maintenance Data and Operating Instructions: Submit for approval three (3) copies of operation and maintenance manuals for the owners use. Manuals shall include manufacturer’s installation and operation procedures for each piece of equipment. Manuals shall also include a copy of the Testing and Balancing report. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets. Contractor shall provide scheduled training to the owner for all equipment provided and installed.

1.3 SUBSTITUTIONS

A. Substitutions: Substitution of specified equipment will be allowed through a prior approval process initiated by the contractor. Contractor shall submit intended substitution at least five days prior to bid for approval from Engineer. Submittal shall include capacities, dimensions and operating instructions for each piece of equipment. Substitution shall occur at no cost to the owner. Contractor is responsible for coordination of approved substitution and shall

incur all costs associated with the substitution including structural modifications, space layout and redesign costs.

1.4 EXAMINATION OF SITE, DRAWINGS, SPECIFICATIONS

A. Examine carefully the site and conditions of the site. Provide all necessary equipment and labor to install a complete working system within the site conditions.

B. Examine the drawings and specifications and 5 days prior to bidding report any errors, omissions, inconsistencies, and conflicts to the engineer to be remedied in an addendum to the project prior to bid time.

C. Drawings are diagrammatic and catalog numbers given are for reference only. The contractor shall be responsible for verifying the capacity of the equipment meets the drawing requirements and shall not dimension from the mechanical, plumbing, or piping drawings.

D. The latest adopted versions of the International Building codes shall be used as required. This will also include the latest adopted versions of the Mechanical, Plumbing and Energy Conservation Codes. All methods and materials required by these codes shall be required by these specifications unless indicated otherwise. Other applicable local codes and ordinances shall be as required and it shall be the contractor's responsibility to be knowledgeable of these requirements.

E. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material

PART 2 PRODUCTS

2.1 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

A. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.

E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.2 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Acrylic; refer to Section 07900.

2.3 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.4 FORMED STEEL CHANNEL

A. Product Description:Galvanized 12 gage) thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Install plastic nameplates with adhesive.

B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

END OF SECTION

SECTION 15051

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittals and substitutions
2. Identification for HVAC Piping and Equipment.
3. Sleeves.
4. Mechanical sleeve seals.
5. Formed steel channel.

1.2 SUBMITTALS

A. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

B. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

C. Product Data: Submit for mechanical approval the manufacturers catalog literature for each product required. Submit information showing capacities, dimensions and installation and operating procedures. Submittal information shall be bound in clearly identified 3-ring binders that are indexed and tabbed for the project. Number of submittals shall be as required in the General Conditions section 1300 or a minimum of five (5) copies.

D. Maintenance Data and Operating Instructions: Submit for approval three (3) copies of operation and maintenance manuals for the owners use. Manuals shall include manufacturer’s installation and operation procedures for each piece of equipment. Manuals shall also include a copy of the Testing and Balancing report. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets. Contractor shall provide scheduled training to the owner for all equipment provided and installed.

1.3 SUBSTITUTIONS

A. Substitutions: Substitution of specified equipment will be allowed through a prior approval process initiated by the contractor. Contractor shall submit intended substitution at least five days prior to bid for approval from Engineer. Submittal shall include capacities, dimensions and operating instructions for each piece of equipment. Substitution shall occur at no cost to the owner. Contractor is responsible for coordination of approved substitution and shall

incur all costs associated with the substitution including structural modifications, space layout and redesign costs.

1.4 EXAMINATION OF SITE, DRAWINGS, SPECIFICATIONS

A. Examine carefully the site and conditions of the site. Provide all necessary equipment and labor to install a complete working system within the site conditions.

B. Examine the drawings and specifications and 5 days prior to bidding report any errors, omissions, inconsistencies, and conflicts to the engineer to be remedied in an addendum to the project prior to bid time.

C. Drawings are diagrammatic and catalog numbers given are for reference only. The contractor shall be responsible for verifying the capacity of the equipment meets the drawing requirements and shall not dimension from the mechanical, plumbing, or piping drawings.

D. The latest adopted versions of the International Building codes shall be used as required. This will also include the latest adopted versions of the Mechanical, Plumbing and Energy Conservation Codes. All methods and materials required by these codes shall be required by these specifications unless indicated otherwise. Other applicable local codes and ordinances shall be as required and it shall be the contractor's responsibility to be knowledgeable of these requirements.

E. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

PART 2 PRODUCTS

2.1 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

A. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.

E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.2 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

E. Sealant: Acrylic

2.3 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.4 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.5 MOTORS, STARTERS, WIRING

A. Furnish and set in place motors, controls and wiring necessary to operate mechanical equipment in accordance with the following schedule. Starters shall have Hand-Off-Auto, two N.O. contacts and two N.C. contacts. 480 volt starters shall have a 120 volt control transformer sized for the auxiliary equipment provided. Enclosures shall be NEMA 1 unless otherwise indicated. Fuses for the disconnect switches shall be provided under the electrical division.

RESPONSIBLE DIVISION

ITEM	FURNISHED	SET	POWER-WIRED	CONTROL WIRED
Equipment	15	15	16	–
Mag Motor Starters	15	16	16	15
Disconnect Switches	16(1)	16(1)	16	–
Switches, Manual and Multi-speed	15	16	16	–

Controls, Relays, Transformers	15	15	16	15
T'Stats and Time Switches	15	15	16	15
Line Voltage T'Stats	15	15	16	16
T.C. Control Panels	15	15	16	15
Motor and Solenoid Valves Damper Motors	15	15(2)	–	15(2)
Push Buttons and Pilot Lights	15	15(2)	–	15(2)
HVAC Controls	15	15	16	15
Exhaust Fan Switches	15	16	16	15(2)
Fire Protection Controls	16	16	16	16
Fire and Smoke Detectors	16(3)	16(3)	16	16(3)

(1) Under Division 15 if furnished factory-wired as part of equipment or if furnished with combination starters.

(2) If item is for line voltage, set in place and connect under Division 16. Where factory mounted on equipment or attached to piping or ducts and using line voltage furnish and set under Division 15, connect under Division 16.

(3) For units factory mounted in or on mechanical equipment or ducts, fan stop connections shall be under Division 15, all other connections under Division 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Install plastic nameplates with adhesive.

B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

END OF SECTION

SECTION 15080

PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Piping insulation, jackets and accessories.
   2. Equipment insulation, and covering.

1.2 SUBMITTALS

A. Product Data: Submit product description, list of materials and thickness for each service or equipment scheduled and locations.

B. Manufacturer's Installation Instructions: Submit manufacturer's installation instructions for each product type.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation and related products when ambient temperatures and conditions are not meeting manufacturers requirements.

B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 PIPE INSULATION

A. Manufacturers:
   1. Model.
   2. Johns Manville.
   3. Owens Corning.
   4. Pittsburgh Corning Corp.
   5. Substitutions: Permitted.

B. Man Made Mineral Fiber: ASTM C547; rigid molded, noncombustible.
   1. k (ksi) factor: 0.24 at 75 degrees F.
   2. Maximum service temperature: 850 degrees F.
   3. Vapor Retarder Jacket: White Kraft paper with glass fiber yarn and bonded to aluminized film, secured with self-sealing longitudinal laps and butt strips or with outward clinch expanding staples and vapor retarder mastic.

C. Jackets:
1. PVC Plastic: One piece molded type fitting covers and sheet material, off-white color.
a. Thickness: 10 mil.
b. Connections: Brush on welding adhesive.
2. Aluminum Jacket: 0.025 inch thick sheet, smooth finish, with longitudinal slip joints and 2 inch laps, die shaped fitting covers with factory attached protective liner.
3. Stainless Steel Jacket: Type 302 stainless steel, 0.010 inch thick sheet, smooth finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping and equipment are tested and ready for installation.

3.2 INSTALLATION

A. Continue insulation vapor barrier through penetrations.

B. Piping Insulation:
1. Locate insulation and cover seams in least visible locations.
2. Neatly finish insulation at supports, protrusions, and interruptions.
3. Insulate complete system of pipes conveying fluids below ambient temperature.
4. Install fiber glass insulated pipes conveying fluids below ambient temperature with vapor barrier jackets. Finish with glass cloth and vapor barrier adhesive.
5. For man made mineral fiber insulated pipes conveying fluids above ambient temperature, install standard jackets. Bevel and seal ends of insulation at equipment, flanges, and unions.
6. Install insert between support shield and piping on piping 2 inches diameter or larger. Fabricate of cork or other high density insulating material suitable for temperature, not less than 6 inches long.
7. For pipe exposed in mechanical equipment rooms or in finished spaces below 10 feet above finished floor, finish with canvas jacket sized for finish painting PVC jacket and fitting covers aluminum jacket stainless steel jacket.
8. For exterior applications, install vapor barrier jacket. Insulate pipe, fittings, joints, and valves and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 SCHEDULES

A. Piping Insulation:
1. Domestic Hot, Recirculation and Cold Water:
a. Glass Fiber Insulation.
1) Pipe Size Range: all.
2) Thickness: 1 inch.

2. Roof Drain Bodies:
    a. Glass Fiber Insulation.
        1) Thickness: 1/2 inch.
3. Roof Drainage within building:
    a. Glass Fiber Insulation.
        1) Thickness: 1/2 inch.
4. Piping Exposed to Freezing:
    a. Glass Fiber Insulation.
        1) Thickness: 1 inch.

END OF SECTION

SECTION 15081

HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Piping insulation, jackets and accessories.
   2. Ductwork insulation and jackets.
   3. Internal ductwork insulation.

1.2 SUBMITTALS

A. Product Data: Submit product description, list of materials and thickness for each service or equipment scheduled and locations.

B. Manufacturer's Installation Instructions: Submit manufacturer's installation instructions for each product type.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation and related products when ambient temperatures and conditions are not meeting manufacturers requirements.

B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 PIPE INSULATION

A. Manufacturers:
   1. Johns Manville Model.
   2. Owens Corning Model.
   3. Pittsburgh Corning Corp. Model.
   4. Substitutions: Permitted.

B. Man Made Mineral Fiber: ASTM C547; rigid molded, noncombustible.
   1. k (ksi) factor: 0.24 at 75 degrees F.
   2. Maximum service temperature: 850 degrees F.
   3. Vapor Retarder Jacket: White Kraft paper with glass fiber yarn and bonded to aluminized film, secured with self-sealing longitudinal laps and butt strips or with outward clinch expanding staples and vapor retarder mastic.

C. Jackets:
   1. PVC Plastic: One piece molded type fitting covers and sheet material, off-white color.
      a. Thickness: 10 mil.
      b. Connections: Brush on welding adhesive.
   2. Aluminum Jacket: 0.025 inch thick sheet, smooth finish, with longitudinal slip joints and 2 inch laps, die shaped fitting covers with factory attached protective liner.

2.2 DUCTWORK INSULATION

A. Flexible Glass Fiber: ASTM C553; flexible, noncombustible blanket.
   1. k (ksi) Value: 0.29 at 75 degrees F.
   2. Vapor Retarder Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, secured with pressure sensitive tape.

B. Rigid Glass Fiber: ASTM C612; rigid, noncombustible blanket.
   1. k (ksi) Value: 0.29 at 75 degrees F.
   2. Density: 3.0 lb/cu ft.
   3. Vapor Retarder Jacket: Kraft paper with glass fiber yarn and bonded to aluminized film, secured with pressure sensitive tape.

C. Aluminum Jacket: 0.025 inch thick sheet, smooth finish, with longitudinal slip joints and 2 inch laps.

D. Duct Liner: ASTM C1071; flexible, noncombustible blanket with poly vinyl acetate polymer impregnated surface and edge coat.
   1. k (ksi) Value: ASTM C1071.
   2. Maximum Velocity on Coated Air Side: 5,000 ft/min.
   3. Adhesive: Waterproof fire-retardant type.
   4. Liner Fasteners: Galvanized steel, self-adhesive pad or welded with press-on head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping, equipment and ductwork are tested and ready for installation.

3.2 INSTALLATION

A. Install duct liner in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Continue insulation vapor barrier through penetrations.

C. Piping Insulation:
   1. Locate insulation and cover seams in least visible locations.
   2. Neatly finish insulation at supports, protrusions, and interruptions.

3. Insulate complete system of pipes conveying fluids above and below ambient temperature as listed below.
4. Install fiber glass insulated pipes conveying fluids below ambient temperature with vapor barrier jackets. Finish with glass cloth and vapor barrier adhesive.
5. For man made mineral fiber insulated pipes conveying fluids above ambient temperature, install standard jackets. Bevel and seal ends of insulation at equipment, flanges, and unions.
6. Install insert between support shield and piping on piping 2 inches diameter or larger. Fabricate of cork or other high density insulating material suitable for temperature, not less than 6 inches long.
7. For exterior applications, install vapor barrier jacket. Insulate pipe, fittings, joints, and valves and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

D. External Ductwork Insulation (Wrap):
1. For insulated ductwork conveying air below ambient temperature install vapor barrier jacket. Finish with tape. Seal vapor barrier penetrations with vapor barrier adhesive.
2. For insulated ductwork conveying air above ambient temperature install with or without standard vapor barrier jacket. Where service access is required, bevel and seal ends of insulation.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging.
5. For exterior applications, install insulation with vapor barrier jacket. Cover with outdoor aluminum jacket or install with duct liner as scheduled below.

E. Duct Liner:
1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
3. Seal liner surface penetrations with adhesive.
4. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

A. Piping Insulation:
1. Heating Water Supply and Return:
   a. Glass Fiber Insulation.
      1) Pipe Size Range: up to 1-1/2 inch.
      2) Thickness: 1 inch.
      3) Pipe Size Range: 2inch and above.
      4) Thickness: 2 inch.
2. Chilled Water Supply and Return:
   a. Glass Fiber Insulation.
      1) Pipe Size Range: up to 1-1/2 inch.
      2) Thickness: 1 inch.
      3) Pipe Size Range: 2inch and above.

4) Thickness: 1-1/2 inch.

3. Piping Exposed to Freezing:
   a. Glass Fiber Insulation.
      1) Thickness: 1/2 inch.

B. Ductwork Insulation:
   1. Exhaust Ducts within 10 ft of Exterior Openings:
      a. Flexible Glass Fiber: 1/2 inch thick.
      b. Duct Liner: 1/2 inch thick.
   2. Supply and Return Air Ducts (Cooling and Heating Systems):
      a. Glass Fiber Insulation Wrap: 1-1/2 inch thick.
      b. Or Glass Fiber Insulation Liner: 1 inch thick.
   3. Exterior (outdoor) Supply and Return Air Ducts (Cooling and Heating Systems):
      a. Glass Fiber Insulation Wrap: 2-1/2 inch thick.
      b. Or Glass Fiber Insulation Liner: 2 inch thick.
   4. Combustion Air Ducts:
      a. Glass Fiber Insulation: 1/2 inch thick.

END OF SECTION

SECTION 15100

PLUMBING PIPING AND PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Pipe and pipe fittings.
   3. Valves.
   4. Piping specialties.
   5. Plumbing drainage specialties.
   6. Plumbing supply specialties.
   7. Plumbing pumps.

1.2 SUBMITTALS

A. Product Data:
   1. Pipe Hangers and Supports: Submit manufacturers catalog data including load carrying capacity.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Plumbing drainage specialties: Submit manufacturers catalog information with sizes, capacities, rough-in requirements, service sizes, and finishes.
   4. Plumbing supply specialties: Submit manufacturers catalog information with sizes, capacities, rough-in requirements, service sizes, and finishes.
   5. Pumps: Include capacities, pump curves, equipment performance, and electrical characteristics.

B. Pipe Hangers and Supports: Design data, indicate pipe sizes, load carrying capacity of trapeze, multiple pipe, and riser support hangers.

C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit spare parts lists and maintenance procedures.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Conform to ASME B31.9.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.

E. Hangers for Hot Pipe Sizes 6 inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

G. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.

H. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

I. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

J. Vertical Support: Steel riser clamp.

K. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

L. Floor Support for Hot Pipe Sizes to 4 inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

M. Floor Support for Hot Pipe Sizes 6 inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

N. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

2.2 PIPES AND TUBES

A. Sanitary Sewer Piping, Buried Within 5 Feet of Building and Sanitary Sewer Piping, above Grade:
   1. Cast Iron Pipe: ASTM A74, service weight, with neoprene gaskets.
   2. Cast Iron Pipe: CISPI 301, hubless, service weight, with neoprene gaskets and stainless steel clamps.
   3. Copper Tube: ASTM B306, type DWV with cast bronze or wrought copper fittings and Grade 50B solder joints.

4. PVC Pipe: ASTM D2665 or ASTM D3034 with PVC fittings and solvent weld joints (when not in a return air plenum).
5. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679 with PVC fittings and elastomeric gasket joints (when not in a return air plenum).

B. Water Piping, Buried Within 5 Feet of Building:
1. Copper Tubing: ASTM B42, annealed without fittings.
2. Ductile Iron Pipe: AWWA C151 with ductile iron fittings rubber gasket joints and 3/4 inch diameter rods.

C. Water Piping, above Grade:
1. Copper Tubing: ASTM B88, Type L, hard drawn, with cast brass or wrought copper fittings and Grade 95TA solder joints.

D. Storm Water Piping, Buried Within 5 Feet of Building and Storm Water Piping, above Grade:
1. Cast Iron Pipe: ASTM A74 service weight with neoprene gaskets.
2. Cast Iron Pipe: CISPI 301, hubless, service weight with neoprene gaskets and stainless steel clamps.
3. Copper Pipe: ASTM B306, type DWV with cast bronze or wrought copper fittings and Grade 50B solder joints.
4. PVC Pipe: ASTM D2665 or ASTM D3034 with solvent weld joints (when not in a return air plenum).

E. Equipment Drains, Condensate Drains and Overflows:
1. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, PVC fittings, solvent weld joints (when not in a return air plenum).
2. Copper Tubing: ASTM B88, Type M, hard drawn, with cast brass or wrought copper fittings and Grade 95TA solder joints.

2.3 VALVES

A. Gate Valves:
1. Up to 2 inches: Bronze body, bronze trim, non-rising stem, hand wheel, inside screw, double wedge disc, soldered or threaded.
2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, solid wedge, flanged or grooved ends.

B. Ball Valves:
1. Up to 2 inches: Bronze or stainless steel one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.
2. Over 2 inches: Cast steel flanged body, chrome plated steel ball, Teflon seat and stuffing box seals and lever handle.

C. Plug Valves:
1. Up to 2 inches: Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends.

2. Over 2 inches: Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends.

D. Butterfly Valves:
1. Up To 2 inches: Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, 10-position lever handle.
2. Over 2 inches: Iron body, chrome plated iron disc, resilient replaceable seat, wafer or lug ends, extended neck, 10 position lever handle.

E. Swing Check Valves:
1. Up to 2 inches: Bronze body and swing disc, solder or threaded ends.
2. Over 2 inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

F. Spring Loaded Check Valves:
1. Iron body, bronze trim with threaded, wafer or flanged ends and stainless steel spring with renewable composition disc.

G. Relief Valves:
1. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.4 PIPING SPECIALTIES

A. Flanges, Unions, and Couplings:
1. Pipe Size 2 inches and Under: Malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
2. Pipe Size Over 2 inches: Forged steel flanges for ferrous piping; bronze flanges for copper piping; preformed neoprene gaskets.
3. Grooved and Shouldered Pipe End Couplings: Malleable iron housing, C-shape elastomer composition sealing gasket, steel bolts, nuts, and washers.
4. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Strainers:
1. Size 2 inches and Under: Threaded brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
2. Size 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
3. Size 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

C. Flexible Connectors:
1. Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 350 psig.

D. Pressure Gages:

1. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
    a. Case: Cast aluminum.
    b. Bourdon Tube: Type 316 stainless steel.
    c. Dial Size: 4 inch diameter.
    d. Mid-Scale Accuracy: two percent.
    e. Scale: Psi.

E. Thermometers:
1. Stem Type Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish.
    a. Size: 7 inch scale.
    b. Window: Clear Lexan.
    c. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
    d. Accuracy: 2 percent.
    e. Calibration: Degrees F.

2. Dial Type Thermometer: ASTM E1, stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
    a. Size: 3 inch diameter dial.
    b. Lens: Clear Lexan.
    c. Accuracy: 1 percent.
    d. Calibration: Degrees F.

2.5 PLUMBING DRAINAGE SPECIALTIES

A. Roof Drains:
1. Roof Drains: Lacquered cast iron body with sump:
    a. Strainer: Removable metal dome.
    b. Accessories: Coordinate with roofing type:
        1) Membrane flange and membrane clamp with integral gravel stop.
        2) Adjustable under deck clamp.
        3) Roof sump receiver.
        4) Waterproofing flange.
        5) Controlled flow weir.
        6) Leveling frame.
        7) Adjustable extension sleeve for roof insulation.
        8) Perforated or slotted ballast guard extension for inverted roof.
        9) Perforated stainless steel ballast guard extension.
2. Roof Overflow Drains: Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended above flood elevation.

B. Floor Drains:
1. Floor Drain (FD-1): Lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2. Floor Drain (FD-2): Lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, with removable perforated sediment bucket and adjustable round strainer.
3. Floor Drain (FD-3): Lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with polished bronze funnel type strainer.

C. Floor Sinks:
1. Floor Sink (FS-1): Lacquered cast iron body with dome strainer.
2. Floor Sink (FS-2): Square lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, clamp collar, sediment bucket, nickel bronze frame and full grate.

D. Cleanouts:
1. Finished Floor: Lacquered cast iron body with anchor flange, reversible clamping collar, and adjustable nickel-bronze round scored cover in service areas and round depressed cover to accept floor finish in finished floor areas.
2. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.6 PLUMBING SUPPLY SPECIALTIES

A. Backflow Preventers:
1. Reduced Pressure Backflow Preventers: ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; pressure relief valve located between check valves; third check valve opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type To PDI WH 201, pre-charged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

C. Hose Bibbs/Hydrants:
1. Interior Hose Bibs: Bronze or brass, replaceable hexagonal disc, hose thread spout, chrome plated with vacuum breaker.
2. Wall Hydrant: Non-freeze, self-draining type with polished bronze lockable recessed box hose thread spout, removable key, and vacuum breaker.

2.7 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. Taco Model.
2. Bell and Gossett Model.

B. Construction: Bronze casing, bronze impeller, alloy steel shaft with integral thrust collar and two oil-lubricated bronze-sleeve bearings and mechanical seal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavate.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside piping before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.4 INSTALLATION - PIPING SYSTEMS

A. Install dielectric connections wherever jointing dissimilar metals.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Route piping parallel to building structure and maintain gradient.

D. Install piping to maintain headroom. Group piping to conserve space. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Sleeve pipe passing through partitions, walls and floors.

H. Install piping system allowing clearance for installation of insulation and access to valves and fittings.

I. Install identification on piping systems including underground piping. Refer to Section 15050.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.5 INSTALLATION - VALVES

A. Install valves with stems upright or horizontal, not inverted.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for throttling, bypass, or manual flow control services.

D. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

E. Install spring loaded check valves on discharge of pumps.

F. Install plug valves for throttling service. Install non-lubricated plug valves only when shut-off or isolating valves are also installed.

G. Install 3/4 inch ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

3.6 INSTALLATION - PIPING SPECIALTIES

A. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

C. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

E. Provide drain and hose connection with valve on strainer blow down connection.

F. Test backflow preventers in accordance with ASSE 5013.

3.7 INSTALLATION - PLUMBING SUPPLY PIPING

A. Install water piping in accordance with ASME B31.9.

B. Excavate and backfill in accordance with Section 02300.

C. Establish elevations of buried piping outside the building to obtain not less than 2 ft of cover.

D. Provide support for utility meters in accordance with requirements of utility companies.

E. Slope water piping and arrange to drain at low points.

F. Install piping from relief valves, back-flow preventers and drains to nearest floor drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to washing machine outlets.

H. Provide water service complete with approved reduced pressure back-flow preventer and water meter with by-pass valves pressure reducing valve, and sand strainer.

I. Install flow controls in water circulating systems as indicated on Drawings.

J. Disinfecting of Domestic Water Systems:
   1. Prior to starting, verify system is complete, flushed and clean.
   2. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
   3. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
   4. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
   5. Maintain disinfectant in system for 24 hours.
   6. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
   7. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
   8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.8 INSTALLATION - PLUMBING DRAINAGE PIPING

A. Install bell and spigot pipe with bell end upstream.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Install with clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Establish elevations of buried piping outside building to provide not less than 2 ft of cover.

F. Install piping penetrating roofed areas to maintain integrity of roof assembly.

G. Excavate and backfill in accordance with Section 02300.

H. Install bell and spigot pipe with bell end upstream.

I. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

J. Test drainage piping in accordance with local code requirements.

3.9 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every other floor. Support vertical cast iron pipe at each floor at hub.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.10 INSTALLATION - PUMPS

A. Install line size shut-off valve and strainer on pump suction. Install line size check valve, shut-off valve, on pump discharge.

B. Install pumps with shaft length allowing sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.

3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual. Bleed water from outlets to accomplish distribution.

C. Maintain disinfectant in system for 24 hours. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

D. Flush disinfectant from system. Take samples no sooner than 24 hours after flushing, and analyze in accordance with AWWA C601.

3.12 SERVICE CONNECTIONS

A. Install sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and verify proper slope for drainage and proper cover to avoid freezing.

B. Install new water service complete with water meter with by-pass valves. Install sleeve in wall for service main and supported at wall, calked and made watertight.

C. Install new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 10 inch wg.

3.13 SCHEDULES

A. Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8

Aluminum (All sizes)	10	1/2
Brass		
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
Fiberglass	4	1/2
Glass	8	1/2
Polybutylene	2.67	3/8
Polypropylene	4	3/8
PVC (All Sizes)	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION

SECTION 15180

HEATING AND COOLING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Pipe and pipe fittings.
3. Valves.
4. Piping specialties.
5. HVAC piping specialties.
6. HVAC pumps.
7. Chemical treatment.

1.2 SUBMITTALS

A. Shop Drawings: Indicate schematic layout of refrigeration system, including equipment, critical dimensions, and sizes.

B. Product Data:
1. Pipe Hangers and Supports: Submit manufacturers catalog data including load carrying capacity.
2. Valves: Submit Manufacturers catalog information with valve data and ratings for each service.
3. Piping Specialties: Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
4. Pipe Expansion Products: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements. Include manufacturers catalogue information.
6. Chemical Treatment: Submit chemical treatment materials, chemicals, and equipment.

C. Welders Certificate: Include welders certification of compliance with AWS D1.1.

D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment pumps, valves and accessories.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit spare parts lists and maintenance procedures.

1.4 MAINTENANCE SERVICE

A. Furnish maintenance services of chemical water treatment for one year from Date of Substantial Completion.

B. Furnish chemicals for treatment and testing during warranty period.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Conform to ASME B31.1.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

C. Hangers for Cold Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.

E. Hangers for Hot Pipe Sizes 6 inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

F. Multiple or Trapeze Hangers for Pipe Sizes to 4 inches: Steel channels with welded spacers and hanger rods.

G. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll and stand.

H. Wall Support for Pipe Sizes to 3 inches: Cast iron hooks.

I. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

J. Wall Support for Hot Pipe Sizes 6 inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

K. Vertical Support: Steel riser clamp.

L. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

M. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

N. Floor Support for Hot Pipe Sizes 6 inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

O. Copper Pipe Support: Copper-plated, carbon steel ring.

2.2 PIPES AND TUBES

A. Heating Water Piping:
   1. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40, black, malleable iron or forged steel fittings, threaded or welded joints.
   2. Copper Tubing: ASTM B88, Type M hard drawn, cast brass, wrought copper, or mechanically extracted fittings, lead free solder joints.

B. Chilled Water Piping:
   1. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40, black, malleable iron or forged steel fittings, threaded or welded joints.
   2. Copper Tubing: ASTM B88, Type M hard drawn, cast brass, wrought copper, or mechanically extracted fittings, lead free solder joints.

C. Refrigerant Piping:
   1. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed, wrought copper fittings, silver/phosphorus/copper alloy brazed joints.
   2. Copper Tubing to 7/8 inch OD: ASTM B88, Type K, annealed, cast copper fittings, flared joints.
   3. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40, black steel, forged steel welding type fittings, welded joints.

D. Equipment Drains and Overflows:
   1. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40 black steel, malleable iron or forged steel fittings, threaded or welded joints.
   2. Copper Tubing: ASTM B88, Type M, hard drawn, cast brass, wrought copper or mechanically extracted fittings, lead free solder joints.
   3. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, PVC fittings, solvent weld joints (when not in a return air plenum).

2.3 VALVES

A. Gate Valves:
   1. Up to 2 inches: Bronze body, bronze trim, non-rising stem, hand wheel, inside screw, double wedge disc, soldered or threaded.
   2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, solid wedge, flanged or grooved ends.

B. Globe Valves:
   1. Up to 2 Inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable composition disc, solder or threaded ends, with back seating capacity.
   2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug type disc, flanged ends, renewable seat and disc.

C. Ball Valves:
   1. Up to 2 inches: Bronze or stainless steel one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.
   2. Over 2 inches: Cast steel flanged body, chrome plated steel ball, Teflon seat and stuffing box seals and lever handle.

D. Plug Valves:
   1. Up to 2 inches: Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends.
   2. Over 2 inches: Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends.

E. Butterfly Valves:
   1. Up To 2 inches: Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, 10-position lever handle.
   2. Over 2 inches: Iron body, chrome plated iron disc, resilient replaceable seat, wafer or lug ends, extended neck, 10 position lever handle.

F. Swing Check Valves:
   1. Up to 2 inches: Bronze body and swing disc, solder or threaded ends.
   2. Over 2 inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

G. Spring Loaded Check Valves:
   1. Iron body, bronze trim with threaded, wafer or flanged ends and stainless steel spring with renewable composition disc.

H. Relief Valves:
   1. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.4 PIPING SPECIALTIES

A. Flanges, Unions, and Couplings:
   1. Pipe Size 2 inches and Under: Malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
   2. Pipe Size Over 2 inches: Forged steel flanges for ferrous piping; bronze flanges for copper piping; preformed neoprene gaskets.
   3. Grooved and Shouldered Pipe End Couplings: Malleable iron housing, C-shape elastomer composition sealing gasket, steel bolts, nuts, and washers.
   4. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Strainers:
   1. Size 2 inches and Under: Threaded brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Size 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
   3. Size 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

C. Flexible Connectors:
   1. Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 350 psig.

D. Air Vents:
   1. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
   2. Float Type: Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

E. Pipe Expansion Compensation Devices:
   1. Two-ply Bronze Bellows Type:
      a. Construction: Bronze with anti-torque device, limit stops, internal guides.
      b. Pressure Rating: 200 psi WOG and 250 degrees F.
      c. Maximum Compression: 3 inch.
      d. Maximum Extension: 1/4 inch.
      e. Joint: As specified for pipe joints.
      f. Size: Use pipe sized units.
      g. Application: Copper piping.
   2. Low Pressure Compensators with two-ply Bronze Bellows:
      a. Working Pressure: 75 psig.
      b. Maximum Temperatures: 250 degrees F.
      c. Maximum Compression: 1/2 inch.
      d. Maximum Extension: 5/32 inch.
      e. Joint: Soldered.
      f. Size: Use pipe sized units.
      g. Application: Copper or steel piping 2 inch and under.
   3. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

F. Pressure Gages:
   1. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
      a. Case: Cast aluminum.
      b. Bourdon Tube: Brass.
      c. Dial Size: 3-1/2 inch diameter.
      d. Mid-Scale Accuracy: two percent.
      e. Scale: Psi.

G. Thermometers:
1. Stem Type Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
a. Size: 9 inch scale.
b. Window: Clear glass.
c. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
d. Accuracy: 2 percent.
e. Calibration: Degrees F.

2. Dial Type Thermometer: ASTM E1, stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
a. Size: 3 inch diameter dial.
b. Lens: Clear Lexan.
c. Accuracy: 1 percent.
d. Calibration: Degrees F.

2.5 HVAC PIPING SPECIALTIES

A. Expansion Tanks:
1. Construction: Closed, welded steel, ASME tested and labeled, 100 psig rating; cleaned, prime coated, and supplied with steel support saddles; with taps for installation of accessories.
2. Gage Glass Set: Brass compression stops, guard, and 3/4 inch glass.
3. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventor, test cocks, strainer, vacuum breaker, and by-pass with valves.

B. Air Separators:
1. In-Line Air Separators: Cast iron for sizes 1-1/2 inch and smaller, or steel for sizes 2 inch and larger; ASME tested and stamped; for 125 psig operating pressure.

2. Angle or straight pattern, rising stem, inside screw globe valve for 125 psig working pressure, with bronze body and integral union for threaded connections, renewable composition disc, plastic wheel handle for shut-off service, and lock shield key cap and set screw memory bonnet for balancing service.

2.6 HVAC PUMPS

A. Manufacturers:
1. Armstrong.
2. Taco Model.
3. Bell and Gossett.
4. Substitutions: Permitted.

B. System Lubricated Circulators:

1. Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 140 psig maximum working pressure, 230 degrees F maximum water temperature.
2. Construction: Cast iron casing flanged pump connections, stainless steel impeller, shaft, and rotor, impedance protected motor.

C. In-Line Circulators:
1. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psig maximum working pressure.
2. Construction: Cast iron casing with flanged connections, cadmium plated steel impeller keyed to shaft, two oil lubricated bronze sleeve bearings, alloy steel shaft with sleeve, integral thrust collar, mechanical seal; flexible coupling.

D. Vertical In-Line Pumps:
1. Type: Vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 175 psig working pressure.
2. Construction: Cast iron casing with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge, bronze, fully enclosed impeller keyed directly to motor shaft or extension, mechanical seal.

E. Close Coupled Pumps:
1. Type: Horizontal shaft, single stage, close coupled, radially split casing, for 125 psig maximum working pressure.
2. Construction: Cast iron casing with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge, bronze, fully enclosed impeller keyed to motor shaft extension, mechanical seal.

F. Base Mounted Pumps:
1. Type: Horizontal shaft, single stage, direct-connected. Radially or horizontally split casing, for 125 psig maximum working pressure.
2. Construction: Cast iron casing with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge, bronze, fully enclosed impeller keyed to shaft, oil lubricated roller or ball bearings, mechanical seal; flexible coupling with guard.
3. Baseplate: Cast iron or fabricated steel with integral drain rim.

2.7 CHEMICAL TREATMENT

A. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents.

B. Closed System Treatment (Water):
1. Sequestering agent to reduce deposits and adjust pH.
2. Corrosion inhibitors.
3. Conductivity enhancers.

C. By-pass (Pot) Feeder: 2 quart with quick opening cap.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavate.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside piping before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.4 INSTALLATION - PIPING SYSTEMS

A. Install dielectric connections wherever jointing dissimilar metals.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Route piping parallel to building structure and maintain gradient.

D. Install piping to maintain headroom. Group piping to conserve space. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Sleeve pipe passing through partitions, walls and floors.

H. Install piping system allowing clearance for installation of insulation and access to valves and fittings.

I. Install identification on piping systems including underground piping. Refer to Section 15051.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.5 INSTALLATION - VALVES

A. Install valves with stems upright or horizontal, not inverted.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for throttling, bypass, or manual flow control services.

D. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

E. Install spring loaded check valves on discharge of pumps.

F. Install plug valves for throttling service. Install non-lubricated plug valves only when shut-off or isolating valves are also installed.

G. Install butterfly valves in heating water systems, in chilled water systems, interchangeably with gate and globe valves.

H. Install only butterfly valves in chilled, water systems for throttling and shut-off service.

I. Install 3/4 inch ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest drain.

3.6 INSTALLATION - PIPING SPECIALTIES

A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.

B. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

D. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

E. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

F. Install manual air vents at system high points.

G. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.

H. Install air separator on suction side of system circulation pump and connect to expansion tank.

I. Provide drain and hose connection with valve on strainer blow down connection.

J. Provide radiator valves on water inlet for the following terminal heating unit types: radiation, unit heaters, and.

K. Provide radiator-balancing valves on water outlet for the following terminal heating unit types: radiation, unit heaters, and.

L. Pipe relief valve outlet to nearest floor drain.

3.7 INSTALLATION - HEATING AND COOLING PIPING

A. Install heating water and chilled water piping in accordance with ASME B31.1.

B. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

C. Support tanks inside building from building structure.

D. Install relief valves on expansion tanks.

E. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment. Install piping from relief valve outlet to nearest floor drain.

F. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.

G. Install line size shut-off valve and strainer on pump suction. Install line size check valve, balancing valve, and shut-off valve on pump discharge.

H. Install air cock and drain connection on horizontal pump casings. Install drain piping for bases and seals, piped to and discharging into floor drains. Lubricate pumps before start-up.

I. Install close coupled and base mounted pumps on concrete base, specified in Section 03050, with anchor bolts, set and level, and grout in place.

J. Install bypass feeder for heating water, chilled water, systems. Install across pump with flow from pump discharge to pump suction from pump taps.

K. Cleaning:
   1. After completion, fill, start, and vent prior to cleaning. Use water meter to record capacity in each system. Place terminal control valves in open position during cleaning.
   2. Add cleaner to closed systems at concentration as recommended by manufacturer.
   3. Hot Water Heating Systems: Apply heat and circulate for 12 hours minimum. Remove heat and cool; drain systems and refill with clean water. Circulate for 6 hours at design temperatures, then drain. Refill with clean water. Repeat until system cleaner is removed.
   4. Chilled Water Systems: Circulate for 48 hours, then drain. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water. Repeat until system cleaner is removed.
   5. Flush open systems with clean water for one-hour minimum. Drain completely and refill.
   6. Remove, clean, and replace strainer screens. Disassemble system components to inspect and remove sludge. Flush low points with clean water after cleaning process is completed.

3.8 INSTALLATION - REFRIGERANT PIPING

A. Install refrigerant piping in accordance with ASME B31.5.

B. Arrange refrigeration piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

C. Flood refrigerant piping system with nitrogen when brazing.

D. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

E. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.

F. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

G. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

H. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

I. Fully charge completed system with refrigerant after testing.

J. Provide electrical connection to solenoid valves.

K. Test refrigeration system in accordance with ASME B31.5.

L. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using electronic leak detector. Test to no leakage.

3.9 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every other floor. Support vertical cast iron pipe at each floor at hub.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.10 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches

1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2 (Note 2)	9	11	1/2	1/2
3	10	12	1/2	1/2
4	12	14	1/2	5/8
5	13	16	1/2	5/8
6	14	17	5/8	3/4
8	16	19	3/4	3/4
10	18	22	3/4	7/8
12	19	23	3/4	7/8
14	22	25	7/8	1
16	23	27	7/8	1
18	25	28	1	1
20	27	30	1	1-1/4
24	28	32	1-1/4	1-1/4

B. Plastic and Ductile Iron Pipe Hanger Spacing:

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
FRP (All Sizes)	4	3/8
Ductile Iron (Note 2)		
PVC (All Sizes)	4	3/8

C. Note 1:Refer to manufacturer's recommendations for grooved end piping systems.

D. Note 2: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection.

For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

END OF SECTION

SECTION 15195

FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Natural gas piping above grade.
2. Unions and flanges.
3. Valves.
4. Pipe hangers and supports.
5. Strainers.
6. Natural gas pressure regulators.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
4. ASME B31.9 - Building Services Piping.
5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
5. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
6. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

E. American Water Works Association:
1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 67 - Butterfly Valves.
   3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
   5. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
   6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

G. National Fire Protection Association:
   1. NFPA 54 - National Fuel Gas Code.

H. Underwriters Laboratories Inc.:
   1. UL 842 - Valves for Flammable Fluids.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

C. Provide pipe hangers and supports in accordance with ASME B31.9.

D. Use plug, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 SUBMITTALS

A. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
   4. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:
      a. Strainers.
      b. Natural gas pressure regulators.
      c. Natural gas pressure relief valves.

B. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

C. Test Reports: Indicate results of piping system pressure test.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves, piping system, and system components.

B. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists, and exploded assembly views.

1.6 QUALITY ASSURANCE

A. Perform natural gas Work in accordance with NFPA 54.

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASTM A234/A234M forged steel welding type.
   2. Joints: ASME B31.9, welded.

3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.2 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
   2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

B. Copper Tubing: ASTM B88, Type K or annealed.
   1. Fittings: ASME B16.26 cast bronze, compression type.
   2. Joints: Flared.

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.4 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 54.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

I. Sheet Lead: ASTM B749, 2.5 lb/sq ft inch thick.

2.5 NATURAL GAS PRESSURE REGULATORS

A. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.
   1. Temperatures: minus 20 degrees F to 150 degrees F.
   2. Body: Cast iron.
   3. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.
   4. Disk, diaphragm, and O-ring: Nitrile.
   5. Maximum inlet pressure: 150 psig.
   6. Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with ASME B31.9.

B. Support horizontal piping hangers as scheduled.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

G. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

H. Provide copper plated hangers and supports for copper piping.

I. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.5 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Sleeve pipe passing through partitions, walls and floors. Refer to Section 15061.

H. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer. Refer to Section.

L. Provide support for utility meters in accordance with requirements of utility company.

M. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

N. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

O. Install identification on piping systems including underground piping.

P. Install valves with stems upright or horizontal, not inverted.

Q. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

R. Install medium pressure gas pressure regulator with tee fitting between regulator and upstream shutoff valve. Cap or plug one opening of tee fitting.

S. Install medium pressure gas pressure regulator with tee fitting not less than 10 pipe diameters down stream of regulator. Cap or plug one opening of tee fitting.

T. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.

U. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 11 inch wg.

3.6 FIELD QUALITY CONTROL

A. Pressure test natural gas piping in accordance with NFPA 54.

B. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

3.7 SCHEDULES

A. Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING MINIMUM HANGER ROD DIAMETER Inches	STEEL PIPE MINIMUM HANGER ROD DIAMETER Inches
1/2	4	6	3/8	3/8
3/4	6	7	3/8	3/8
1	6	7	3/8	3/8

1-1/4	8	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2	8	10	1/2	1/2
3	8	10	1/2	1/2
4	8	10	1/2	5/8
5	8	10	1/2	5/8
6	8	10	5/8	3/4
8	8	10	3/4	3/4

END OF SECTION

SECTION 15400

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water heaters.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's literature for plumbing equipment.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit literature and parts list.

1.4 QUALITY ASSURANCE

A. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR.

PART 2 PRODUCTS

2.1 COMMERCIAL GAS WATER HEATERS

A. Automatic, natural gas fired, vertical storage type:
   1. Storage: as scheduled .
   2. Input: as scheduled.
   3. Minimum recovery rate: as scheduled .
   4. Maximum working pressure: 150 psi.

B. Tanks: Welded steel ASME labeled pressure vessel; glass lined, with ASME rated temperature and pressure relief valve.

C. Controls: Automatic immersion water thermostat with adjustable temperature range, automatic reset high limit thermostat, gas pressure regulator, burner with 100 percent safety shut-off pilot and thermocouple, intermittent electronic ignition and power vent.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install water heaters in accordance to AGA requirements. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

B. Install the following heat exchanger accessories:
   1. ASME rated pressure and temperature relief valve on heated water discharge.

C. Clean and flush tanks after installation. Keep openings sealed until pipe connections are made.

D. On tanks, install drain at water inlet and outlet, thermometer with range of 40 to 200 degrees F, and ASME pressure relief valve suitable for maximum working pressure.

END OF SECTION

SECTION 15401

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Water closets.
2. Urinals.
3. Lavatories.
4. Sinks.
5. Service sinks.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's literature for plumbing fixtures.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit literature and parts list.

PART 2 PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. Bowl: Floor mounted vitreous china closet with elongated rim, 1-1/2 inch spud, china bolt caps; maximum 1.6 gallon flush volume.

B. Flush Valve: Exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker.

C. Seat: Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

D. Wall Mounted Carrier: Adjustable cast iron frame, integral drain hub and vent, adjustable spud. lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.2 WALL HUNG URINALS

A. Urinal: Vitreous china, wall hung urinal with shields, integral trap, removable stainless steel strainer, 3/4 inch top spud, steel supporting hanger; maximum 1.0 gallon flush volume.

B. Flush Valve: Exposed chrome plated, diaphragm type with oscillating handle, escutcheon, integral screwdriver stop, vacuum breaker.

C. Wall Mounted Carrier: Cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.3 LAVATORIES

A. Vitreous China Counter Top Lavatory: Vitreous china self-rimming counter top lavatory, inches with drillings on 8 inch centers, front overflow, soap depression, seal of putty, caulking, or concealed vinyl gasket.

B. Trim: Chrome plated solid brass combination supply fitting with open grid strainer, water economy aerator with maximum 2.0 gpm flow, single lever handle, chrome plated brass P-trap with clean-out plug and arm with escutcheon.

C. Wall Mounted Carrier: Cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, concealed arm supports, bearing plate and studs.

2.4 SINKS

A. Single Compartment Bowl: Single compartment inch outside dimensions, 18 gage thick, Type 316 stainless steel, self-rimming with undercoating, 3/1/2 inch crumb cup and chromed brass drain, ledge back drilled for trim.

B. Trim: Chrome plated brass supply with swing spout, water economy aerator with maximum 2.2 gpm flow, single lever handle and retractable spray; chrome plated brass P-trap with clean-out plug and arm with escutcheon.

2.5 SERVICE SINKS

A. Bowl: 24 x 24 x 10 inch high white molded stone, floor mounted, with one inch wide shoulders, stainless steel strainer.

B. Trim: Exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges. Five feet of 1/2 inch diameter plain end reinforced rubber hose, hose clamp and mop hanger.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adjacent construction is ready to receive rough-in work of this section.

B. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.2 INSTALLATION

A. Install each fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers, and escutcheons.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

END OF SECTION

SECTION 15514

FINNED WATER-TUBE BOILERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Finned water-tube boilers.
2. Boiler controls.
3. Boiler trim.
4. Natural gas fired burner.
5. Expansion tank.

B. Related Sections:
1. Section 15140 - Domestic Water Piping: Execution requirements for cold water piping connections to boilers specified in this section.
2. Section 15180 - Hydronic Piping: Execution requirements for hot water piping for piping connections to boilers specified in this section.
3. Section 15195 - Facility Natural-Gas Piping: Execution requirements for natural gas piping connections to boilers specified in this section.
4. Section 15550 - Breeching, Chimneys, and Stacks: Execution requirements for breeching, chimney, and stack connections to boilers specified in this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z21.13 - Gas-fired Low Pressure Steam and Hot Water Boilers.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. American Society of Mechanical Engineers:
1. ASME Section I - Boiler and Pressure Vessel Code - Power Boilers.
2. ASME Section IV - Boiler and Pressure Vessel Code - Heating Boilers.
3. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. Hydronics Institute:
1. H.I. Heating Boiler Standard - Testing and Rating Standard for Heating Boilers.

E. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.

2. NFPA 58 - Liquefied Petroleum Gas Code.

1.3 SUBMITTALS

A. Product Data: Submit capacities and accessories included with boiler. Include general layout, dimensions, size and location of water, fuel, electric and vent connections, electrical characteristics, weight and mounting loads.

B. Test Reports: Indicate boilers meet or exceed specified performance and efficiency. Submit results of combustion test.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Manufacturers Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Conform to ASME Section IV for construction of boilers with CSD-1 controls. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

B. Boiler Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with H.I. Heating Boiler Standard.

C. Gas Train and Safety Controls: Conform to requirements of Factory Mutual (FM).

D. Unit Certification: UL certified.

E. Conform to applicable code for internal wiring of factory wired equipment.

F. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for purpose specified and indicated.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept boilers and accessories on site in factory shipping packaging. Inspect for damage.

B. Protect boilers from damage by leaving packing in place until installation.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of boilers for one year from Date of Substantial Completion.

B. Provide emergency call back service during working hours for this maintenance period.

C. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

D. Perform maintenance work using qualified personnel under supervision of or original installer.

PART 2 PRODUCTS

2.1 FINNED WATER-TUBE BOILERS

A. Manufacturers:
   1. P-K Thermific.
   2. Substitutions: Permitted.

B. Product Description: Hot water atmospheric draft boiler with horizontal grid, finned tube heat exchanger, gas burning system, refractory combustion chamber, controls, and boiler trim.

C. Boiler Fabrication:
   1. Assembly: Finned copper tube heat exchanger assembled within combustion chamber conforming to ASME Section IV requirements, and tested for maximum working pressure of 160 psi.
   2. Exchanger: Fabricate of finned copper tubing with stainless steel baffles and sealed into bronze, steel, or cast iron headers with silicone O-ring gaskets.

D. Hot Water Boiler Trim:
   1. ASME rated pressure relief valve set at 100 psi.
   2. Inlet flow switch to automatically prevent burner operation when low flow through boiler.
   3. Temperature gage to indicate outlet water temperature.
   4. Pressure gage with scale graduated from 1-1/2 to 3 times safety relief valve set pressure.
   5. Control transformer.
   6. On-off switch with indicator lights.

E. Boiler Fuel Burning System:
   1. Gas Burner: Stainless steel burners for on-off firing and natural gas with adjustable combustion air supply, gas pressure regulator, diaphragm gas valves, manual shut-off, intermittent spark or glow coil ignition, thermistor flame sensing device, and automatic 100 percent safety gas shutoff.
   2. Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven allow gas valve to open.

F. Boiler Controls:
   1. Operating Controls: Factory wired, factory assembled electric control including pilot safety and thermocouple transformer, 24-volt gas valve, manual main and pilot valves, and junction box.
   2. Operating temperature controller to control burner operation to maintain supply water temperature.
   3. Electronic operating temperature controller:
      a. NEMA 250 Type 1 enclosure with full cover for wall mounting.
      b. Ambient temperature range of -30 to 150 degrees F.
   4. High limit temperature controller with manual reset for burner to prevent boiler water temperature from exceeding safe system temperature.

2.2 DIAPHRAGM TYPE EXPANSION TANK

A. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; rated for working pressure of 125 psig, with flexible diaphragm sealed into tank, and steel legs or saddles.

B. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install boilers plumb and level, to plus or minus 1/16 inch over boiler base.

B. Maintain manufacturer's recommended clearances around and over boilers.

C. Install boiler on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than boiler base on each side. Refer to Section 03300.

D. Connect natural gas piping in accordance with NFPA 54.

E. Connect natural gas piping to boiler, full size of boiler gas train inlet. Arrange piping with clearances for burner removal and service.

F. Connect hot water piping to supply and return boiler connections.

G. Install the following piping accessories. Refer to Section 15180.
   1. On supply:
      a. Thermometer well and thermometer.
      b. Well for control system temperature sensor.
      c. Strainer.
      d. Pressure gage.
      e. Shutoff valve.
   2. On return:
      a. Thermometer well and thermometer.
      b. Well for control system temperature sensor.
      c. Pressure gage.
      d. Shutoff valve.
      e. Balancing valve.

H. Install the following piping accessories on natural gas piping connections. Refer to Section 15195.
   1. Strainer.
   2. Pressure gage.
   3. Shutoff valve.
   4. Check valve.
   5. Pressure reducing valve.

I. Install discharge piping from relief valves and drain valves to nearest floor drain.

J. Install circulator and diaphragm expansion tank on boiler.

K. Install boiler trim and accessories furnished loose for field mounting.

L. Install electrical devices furnished loose for field mounting.

M. Install control wiring between boiler control panel and field mounted control devices.

N. Connect flue to boiler outlet, full size of outlet.

3.2 FIELD QUALITY CONTROL

A. Perform combustion test including boiler firing rate, over fire draft, gas flow rate, heat input, burner manifold gas pressure, percent carbon monoxide, percent oxygen, percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output. Perform test at minimum, and high fire.

B. Arrange with local authorities having jurisdiction for inspection of boiler, piping, and for certificate of operation.

3.3 MANUFACTURER'S FIELD SERVICES

A. Start-up boilers according to manufacturer's start-up instructions and in presence of boiler manufacturer's representative. Test controls and demonstrate compliance with requirements. Adjust burner for maximum burning efficiency. Replace damaged or malfunctioning controls and equipment.

3.4 CLEANING

A. Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.

3.5 DEMONSTRATION

A. Demonstrate operation and maintenance procedures.

B. Furnish services for manufacturer's technical representative for one 8 hour day to instruct Owner's personnel in operation and maintenance of boilers. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.

END OF SECTION

SECTION 15550

BREECHING, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Double wall metal stacks.

B. Related Sections:
   1. Section 15514 - Finned Water-Tube Boilers: Boilers using breeching, chimneys, and stacks.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI Z21.66 - Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
   2. ANSI Z21.67 - Mechanically Actuated Automatic Vent Damper Device.
   3. ANSI Z21.68 - Thermatically Actuated Automatic Vent Damper Devices.
   4. ANSI Z95.1 - Oil Burning Equipment, Installation.

B. ASTM International:
   1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   4. ASTM 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.
   5. ASTM C401 - Standard Classification of Alumina and Alumina-Silicate Castable Refractories.

C. National Fire Protection Association:
   1. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.
   2. NFPA 54 - National Fuel Gas Code.
   3. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment.
   4. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Guide for Steel Stack Construction.
   2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
   1. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances.
   2. UL 127 - Factory-Built Fireplaces.
   3. UL 378 - Draft Equipment.
   4. UL 441 - Gas Vents.
   5. UL 641 - Type L Low-Temperature Venting Systems.
   6. UL 959 - Medium Heat Appliance Factory Built Chimneys.

1.3 DEFINITIONS

A. Breeching: Vent Connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Smoke Pipe: Round, single wall vent connector.

D. Vent: Portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

E. Vent Connector: Part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.4 SUBMITTALS

A. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breeching. Submit layout drawings indicating plan view and elevations.

B. Product Data: Submit data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

C. Product Data: Submit data on fans and accessories including fan curves with specified operating point plotted, power, RPM, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 DOUBLE WALL METAL STACKS

A. Furnish double wall metal stacks, tested to UL 103 and UL listed, for use with building heating equipment, in compliance with NFPA 211.

B. Fabricate with 1 inch minimum air space between walls. Construct inner jacket of 20 gage ASTM A167 AL29-4C stainless steel. Construct outer jacket of aluminum coated steel 24 gage for sizes 10 inches to 24 inches and 20 gage for sizes 28 inches to 48 inches.

C. Accessories, UL labeled:
   1. Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.
   2. Exit Cone: Consists of inner cone, and outer jacket, to increase stack exit velocity 1.5 times.
   3. Stack Cap: Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

PART 3 EXECUTION

3.1 PREPARATION

A. Install concrete inserts for support of breeching, chimneys, and stacks in coordination with formwork.

3.2 INSTALLATION

A. Install in accordance with NFPA 54.

B. Install breeching with minimum of joints. Align accurately at connections, with internal surfaces smooth.

C. Support breeching from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breeching, chimneys, and stacks at 12 foot spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for equivalent duct support configuration and size.

D. Pitch breeching with positive slope up from fuel-fired equipment to chimney or stack.

E. Coordinate installation of dampers, and induced draft fans.

F. Install vent dampers, locating close to draft hood collar, and secured to breeching.

G. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

H. Level and plumb chimney and stacks.

I. Clean breeching, chimneys, and stacks during installation, removing dust and debris.

J. Install slip joints allowing removal of appliances without removal or dismantling of breeching, breeching insulation, chimneys, or stacks.

END OF SECTION

SECTION 15800

AIR DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ductwork.
   2. Ductwork accessories.
   3. Fans.
   4. Terminal units.
   5. Air Outlets.
   6. Filters.

1.2 SUBMITTALS

A. Shop Drawings: Indicate products fabricated for Project specific application.

B. Product Data:
   1. Submit sizes, capacities, materials, controls and connections to other work.
   2. Submit catalog performance ratings, construction, electric and duct connections, flashing and dimensions for fans and exhausters.

C. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts lists, and wiring diagrams.

D. Samples: Submit two samples of replacement filter media with frame.

E. Manufacturer's Installation Instructions: Submit relevant instructions.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for filter replacement, spare parts lists, and wiring diagrams.

PART 2 PRODUCTS

2.1 DUCTWORK

A. Duct Materials:
   1. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.
   2. Fasteners: Rivets, bolts, or sheet metal screws.

3. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

B. Ductwork Fabrication:
   1. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
   2. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
   3. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
   4. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   5. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
   6. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

C. Kitchen Hood Exhaust Ductwork Fabrication:
   1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
   2. Exposed Kitchen Hood Exhaust Ducts: Construct of stainless steel ASTM A167, type 316 using continuous external welded joints.
   3. Concealed Kitchen Hood Exhaust Ducts: Construct of 16 gage carbon steel or 18 gage stainless steel ASTM A167, type 316 using continuous external welded joints.

D. Flexible Ducts:
   1. Product Description: Two ply vinyl film supported by helical wound spring steel wire.
      a. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
      b. Maximum Velocity: 4000 fpm.
      c. Temperature Range: -10 degrees F to 160 degrees F.
   2. Product Description: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical-wound spring steel wire.
      a. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
      b. Maximum Velocity: 4000 fpm.
      c. Temperature Range: -20 degrees F to 210 degrees F.

E. Insulated Flexible Ducts:
   1. Product Description: Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
      a. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
      b. Maximum Velocity: 4000 fpm.

c. Temperature Range: -10 degrees F to 160 degrees F.
d. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

2. Product Description: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
   a. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
   b. Maximum Velocity: 4000 fpm.
   c. Temperature Range: -20 degrees F to 210 degrees F.
   d. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

F. Single Wall Spiral Round Ducts:
1. Product Description: UL 181, Class 1, round spiral lock seam duct constructed of galvanized steel.
2. Duct Coating: Polyvinyl chloride plastic, 4 mil thick on outside and 2 mil thick on inside. both sides. Temperature range: minus 30 degrees F to 200 degrees F.
3. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

4. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

G. Transverse Duct Connection System:
1. Product Description: SMACNA "E" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.2 DUCT ACCESSORIES

A. Volume Control Dampers:
   1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
   2. Fabricate splitter dampers of material matching duct gage to 24 inches size in each direction, and two gages heavier for larger sizes. Secure with continuous hinge or rod. Operate with minimum 1/4 inch diameter rod.
   3. Fabricate single blade dampers for duct sizes to 12 x 30 inch.
   4. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   5. Except in round ductwork 12 inches and smaller, furnish end bearings.
   6. Furnish locking, indicating quadrant regulators on single and multi-blade dampers. Where width exceeds 30 inches, furnish regulator at both ends.

B. Turning Devices and Extractors:
   1. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.
   2. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with push-pull operator strap.

C. Flexible Duct Connections:
   1. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, approximately 3 inches wide, crimped into metal edging strip.

D. Duct Access Doors:
   1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
   2. Access doors smaller than 12 inches square secured with sash locks. Access doors with sheet metal screw fasteners are not acceptable.

E. Static Fire Dampers:
   1. Fire Rating: UL 555 classified and labeled as a 1-1/2 hour static fire damper.
   2. Air Flow Rating: UL approved for dual directional air flow.
   3. Integral Sleeve Frame: Minimum 20 gage by 12 inches roll formed, galvanized steel.
      a. Factory Sealant: Apply to dampers in HVAC systems with pressures to maximum 4 inches wg.
   4. Blades:
      a. Style: Curtain type, in airstream.
      b. Action: Spring or gravity closure upon fusible link release.
      c. Orientation: Horizontal.
      d. Material: Minimum 24 gage roll formed, galvanized steel.
   5. Closure Springs: Type 301 stainless steel, constant force type, if required.
   6. Temperature Release Device:
      a. Fusible link, 165 degrees F.
      b. Mounting: Vertical.
   7. Duct Transition Connection, Damper Style:

a. A style - rectangular connection, frame and blades in air stream.
b. B style - rectangular connection, blades out of air stream, high free area.
c. G style - A style connection, grille mounting tabs at end of sleeve for grille.
d. R style - round connection, blades in air stream, non-sealed.
e. RA style - round connection, frame and blades in air stream.
f. LR style - round connection, blades out of air stream, non-sealed.
g. LO style - oval connection, non-sealed.

8. Finish: Mill galvanized.

9. Picture Frame Mounting Angles:
   a. One-piece, roll formed retaining angles 1-1/2 x 1-1/2 inches (38 x 38 mm).
   b. Factory matched and shipped attached to damper.

2.3 FANS

A. Upblast Centrifugal Roof Fans:
   1. Manufacturers:
      a. Greenheck Corp.
      b. Substitutions: permitted.
   2. Fan Unit: Upblast type. V-belt drive, spun aluminum housing with grease tray; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
   3. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
   4. Motor: Open drip proof
   5. Roof Curb: 16 inch high self-flashing of galvanized steel construction with continuously welded seams, built-in cant strips, 1 inch insulation and curb bottom, ventilated double wall, hinged curb adapter, and factory installed nailer strip.
   6. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 Type 3R enclosure.
   7. Accessories:
      a. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

B. Ceiling Fans:
   1. Manufacturers:
      a. Loren Cook Company .
      b. Substitutions: Permitted.
   2. Centrifugal Fan Unit: Direct driven with injection molded resin housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge opening, integral outlet duct collar. Discharge position convertible by moving interchangeable panels.
   3. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
   4. Grille: Molded white plastic.

5. Wheel: DWDI Centrifugal forward curved type constructed of injection molded or polypropylene resin.
6. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection.
7. Accessories:
    a. Wall cap with damper, round duct inlet.
    b. Wall cap with rectangular duct inlet.
    c. Eave elbow.
    d. Roof jack constructed of corrosion resistant, galvanized steel with baked enamel finish.
    e. Roof cap.
    f. Filter box.
    g. Brick vent constructed of extruded aluminum with inlet screen.
    h. Rubber-in-shear vibration isolator.
    i. Ceiling radiation damper.
    j. Fan speed controller.
    k. Time delay relay.

C. Combination Kitchen Hood Supply and Exhaust Fans:
1. Manufacturers:
    a. Greenheck Corp.
    b. Substitutions: Permitted.
2. Exhaust Fan:
    a. Refer to Upblast Centrifugal Roof Fans elsewhere in this section.
3. Supply Fan:
    a. Fan Unit: Belt driven, double width, double inlet centrifugal blower, galvanized steel housing with galvannealed finish; resilient mounted motor; square base to suit roof curb.
    b. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
    c. Motor: Open drip proof
4. Master Control Panel: Factory wired to disconnect switch for supply fan and disconnect switch for exhaust fan. Furnish with fused magnetic starters, overload protection, wiring terminals and weatherproof housing. Furnish with 120 volt control circuit transformer.
5. Fresh Air Intake Section: Constructed of galvanized steel. Size as indicated on Drawings. Galvanized steel duct support at end of intake duct.
6. Filters: 2 inch thick aluminum media, washable and cleanable. Furnish bird screen at filter opening.
7. Roof Curb: Sized to accommodate both fans. 12 inch high self-flashing of galvanized steel construction with continuously welded seams, built-in cant strips, 1-1/2 inch, 3 pound per cubic foot density glass fiber insulation and curb bottom, and factory installed nailer strip.
8. Curb Cap: Galvanized steel, welded construction. Fits over roof curb to accommodate supply fan and exhaust fan. Insulate with 1-1/2 inch, 3 pound per cubic foot density

fiberglass insulation. Furnish vented extension for exhaust fan. Comply with NFPA 96 for fan spacing and vertical separation.

9. Damper: Motor operated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power, spring return.

2.4 AIR OUTLETS AND INLETS

A. Ceiling Diffusers: Square adjustable pattern, stamped or spun, multi-core type diffuser to discharge air in 360 degree pattern, with sectoring baffles where indicated; radial opposed blade damper and equalizing grid; baked enamel off-white finish.

B. Registers/Grilles: Streamlined and individually adjustable blades, two-way deflection, damper; with factory clear lacquer finish.

C. Louvers: 4 inches deep with blades on 45 degree slope, channel frame, birds-screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.
   1. Material: 16 gage thick galvanized steel.
   2. Finish: Factory prime coat finish.
   3. Installation: Exterior flat flange.

D. Roof Hoods: Fabricate air inlet or exhaust hoods in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, of galvanized steel or aluminum. Furnish with removable hood; bird-screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake, and factory prime coat finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment installation are ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION

A. Metal Ducts: Install in accordance with SMACNA Duct Construction Standards - Metal and Flexible.

B. Connect flexible ducts to metal ducts with draw bands.

C. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of airflow.

D. Install flexible connections immediately adjacent to fans and motorized equipment. Install flexible connections specified between fan inlet and discharge ductwork. Prevent flexible connectors being in tension while running.

E. Install back-draft dampers on discharge of exhaust fans.

F. Prevent passage of unfiltered air around filters by installing felt, rubber, or neoprene gaskets.

G. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.

H. Cut openings in ductwork to accommodate thermometers and controllers. Cut pitot tube openings for testing of systems, complete with metal can with spring device or screw to eliminate against air leakage.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities. Apply duct insulation specified in Section 15080.

J. Connect diffusers or troffer boots to low pressure ducts with 5 feet maximum length of flexible duct. Hold in place with strap or clamp.

K. At installer's option, internally or externally insulated sheet metal ductwork may be used.

L. During construction install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

M. Install fire dampers at locations as indicated on Drawings. Install with perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

N. Access Doors: Install access doors at the following locations:
   1. Upstream of each reheat coil.
   2. Before and after each duct mounted filter.
   3. Before and after each duct mounted coil.
   4. Before and after each duct mounted fan.
   5. Before and after each automatic control damper.
   6. Before and after each fire damper.
   7. Downstream of each fan coil unit.
   8. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.

O. Access Door Sizes:Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated on Drawings. Review locations prior to fabrication.

P. Install fire dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
   1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
   2. Install dampers square and free from racking with blades running horizontally.
   3. Do not compress or stretch damper frame into duct or opening.
   4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.

Q. Support terminal units individually from structure. Do not support from adjacent ductwork. Install with minimum of 5 ft of 1 inch thick lined ductwork downstream of units.

R. Install balancing dampers on duct take-off to diffusers and grilles and registers, regardless of whether dampers are specified as part of diffuser, or grille and register assembly.

S. Paint ductwork visible behind air outlets and inlets matte black.

T. Do not operate fans until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

U. Install fans with resilient mountings and flexible electrical leads.

V. Install sheaves required for final air balance.

W. Install safety screen where fan inlet or outlet is exposed.

END OF SECTION

SECTION 15910

DIRECT DIGITAL CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes control equipment and software.

B. Related Sections:
1. Section 15940 - Sequence of Operation: Sequences of operation implemented using products specified in this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI MC85.1 - Terminology for Automatic Control.

1.3 SYSTEM DESCRIPTION

A. Automatic temperature controls field monitoring and control system using field programmable microprocessor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Provide controls for reheat coils, unit heaters, fan coils, and when directly connected to control units.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified.

F. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.4 SUBMITTALS

A. Shop Drawings: Indicate the following:
1. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
2. Connected data points, including connected control unit and input device.

3. System graphics showing monitored systems, data (connected and calculated) point addresses, and operator notations.
4. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
5. Description and sequence of operation for operating, user, and application software.
6. Use terminology in submittals conforming to ASME MC85.1.
7. Coordinate submittals with information requested in Section 15940.

B. Product Data: Submit data for each system component and software module.

C. Manufacturer's Installation Instructions: Submit installation instruction for each control system component.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.
2. Submit data specified in "Submittals" in final "Record Documents" form.

B. Operation and Maintenance Data:
1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 MAINTENANCE SERVICE

A. Furnish service and maintenance of control systems for one years from Date of Substantial Completion.

B. Furnish complete service of controls systems, including callbacks.

C. Furnish four complete inspections per year, one in each season, to inspect, calibrate, and adjust controls. Submit written report after each inspection.

D. Examine unit components bi-monthly. Clean, adjust, and lubricate equipment.

E. Include systematic examination, adjustment, and lubrication of unit, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

F. Perform work without removing units from service during building normal occupied hours.

G. Provide emergency call back service during working hours for this maintenance period.

H. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

I. Perform maintenance work using competent and qualified personnel under supervision of manufacturer or original installer.

J. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

2.1 DIRECT DIGITAL CONTROLS

A. Manufacturers:

1. The Trane Company, Model Summit.
2. Substitutions: Permitted.

2.2 OPERATOR WORKSTATION

A. Manufacturers:
1. Dell Corporation Model.
2. Substitutions: Permitted.

B. Furnish each operator workstation consisting of the following:

C. Personal Computer: IBM PC compatible with sufficient memory and hard drive storage to support graphics, reports, and communication requirements. Furnish with the following minimum configuration requirements:
1. Processor: Pentium 4, 2.66 GHz FSB.
2. Hard Drive: 160 Gigabyte.
3. Memory: 1 Gigabyte DDR SDRAM.
4. Drive 1: 48x CD-ROM.
5. Modem: Auto-dial telephone, 56,000 baud.
6. Ports: Required serial, parallel, network communications, USB, and cables for proper system operation.

7. Expansion Slots: 1 used for LAN card, 1 available.
8. LAN Card: EtherNet - RJ45 (100 base-T minimum).
9. Mouse: two-button optical type wireless.
10. Keyboard: 104 key.

D. Monitor: Minimum of 17 inch color, flat panel display.

E. Operating System: Windows XP.

F. Printer: Furnish each operator workstation with laser printer and associated cables. Printer capable of minimum of 14 pages per minute (PPM) operation and compatible with standard parallel or USB communications or network capable.

G. System Support: Minimum ten (10) work stations connected to multi-user, multi-tasking environment with concurrent capability to:
1. Access DDC network.
2. Access or control same control unit.
3. Access or modify same control unit database.
4. Archive data, alarms, and network actions to hard disk regardless of what application programs are being currently executed.
5. Develop and edit database.
6. Implement and tune DDC control.
7. Develop graphics.
8. Control facility.

2.3 CONTROL UNITS

A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

B. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

C. Control Units Functions:
1. Monitor or control each input/output point.
2. Completely independent with hardware clock/calendar and software to maintain control independently.
3. Acquire, process, and transfer information to operator station or other control units on network.
4. Accept, process, and execute commands from other control unit's or devices or operator stations.
5. Access both data base and control functions simultaneously.
6. Record, evaluate, and report changes of state or value occurring among associated points. Continue to perform associated control functions regardless of status of network.
7. Perform in stand-alone mode:
   a. Start/stop.
   b. Duty cycling.

c. Automatic Temperature Control.
d. Demand control via a sliding window, predictive algorithm.
e. Event initiated control.
f. Calculated point.
g. Scanning and alarm processing.
h. Full direct digital control.
i. Trend logging.
j. Global communications.
k. Maintenance scheduling.

D. Global Communications:
1. Broadcast point data onto network, making information available to other system controls units.
2. Transmit input/output points onto network for use by other control units and use data from other control units.

E. Input/output Capability:
1. Discrete/digital input (contact status).
2. Discrete/digital output.
3. Analog input.
4. Analog output.
5. Pulse input (5 pulses/second).
6. Pulse output (0-655 seconds in duration with 0.01-second resolution).

F. Monitor, control, or address data points. Include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs. Furnish control units with minimum 30 percent spare capacity.

G. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

H. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard-wired LAN or 60 seconds over voice grade phone lines.

I. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from workstation.
2. Control output points but change only database state or value; leave external field hardware unchanged.
3. Enable control-actions on output points but change only data base state or value.

J. Local display and adjustment panel: Portable or Integral to control-unit containing digital display, and numerical keyboard. Display and adjust:
1. Input/output point information and status.
2. Controller set points.

3. Controller tuning constants.
4. Program execution times.
5. High and low limit values.
6. Limit differential.
7. Set/display date and time.
8. Control outputs connected to the network.
9. Automatic control outputs.
10. Perform control unit diagnostic testing.

K. Points in "Test" mode.

2.4 LOCAL AREA NETWORKS (LAN):

A. Furnish communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, less than 3 seconds. Furnish automatic reconfiguration when station is added or lost. In event transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.5 OPERATING SYSTEM SOFTWARE

A. Input/output Capability From Operator Station:
1. Request display of current values or status in tabular or graphic format.
2. Command selected equipment to specified state.
3. Initiate logs and reports.
4. Change analog limits.
5. Add, delete, or change points within each control unit or application routine.
6. Change point input/output descriptors, status, alarm descriptors, and unit descriptors.
7. Add new control units to system.
8. Modify and set up maintenance scheduling parameters.
9. Develop, modify, delete or display full range of color graphic displays.
10. Automatically archive select data even when running third party software.
11. Capability to sort and extract data from archived files and to generate custom reports.
12. Support two printer operations.

13. Alarm printer: Print alarms, operator acknowledgments, action messages, system alarms, operator sign-on and sign-off.
14. Data printer: Print reports, page prints, and data base prints.
15. Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
16. Print selected control unit database.

B. Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

C. Data Base Creation and Support: Use standard procedures for changes. Control unit automatically checks workstation data base files upon connection and verify data base match. Include the following minimum capabilities:
1. Add and delete points.
2. Modify point parameters.
3. Change, add, or delete English language descriptors.
4. Add, modify, or delete alarm limits.
5. Add, modify, or delete points in start/stop programs, trend logs, and other items.
6. Create custom relationship between points.
7. Create or modify DDC loops and parameters.
8. Create or modify override parameters.
9. Add, modify, and delete applications programs.
10. Add, delete, develop, or modify dynamic color graphic displays.

D. Dynamic Color Graphic Displays:
1. Utilizes custom symbols or system supported library of symbols.
2. Sixteen (16) colors.
3. Sixty (60) outputs of real-time live dynamic data for each graphic.
4. Dynamic graphic data.
5. 1,000 separate graphic pages.
6. Modify graphic screen refresh rate between 1 and 60 seconds.

E. Operator Station:
1. Accept data from LAN as needed without scanning entire network for updated point data.
2. Interrogate LAN for updated point data when requested.
3. Allow operator command of devices.
4. Allow operator to place specific control units in or out of service.
5. Allow parameter editing of control units.
6. Store duplicate data base for every control unit and allow down loading while system is on line.
7. Control or modify specific programs.
8. Develop, store and modify dynamic color graphics.
9. Data archiving of assigned points and support overlay graphing of this data using up to four (4) variables.

F. Alarm Processing:

1. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state or value and alarms causing automatic dial-out.
2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
3. Print on line changeable message, up to 60 characters in length, for each alarm point specified.
4. Display alarm reports on video. Display multiple alarms in order of occurrence.
5. Define time delay for equipment start-up or shutdown.
6. Allow unique routing of specific alarms.
7. Operator specifies when alarm requires acknowledgment.
8. Continue to indicate unacknowledged alarms after return to normal.
9. Alarm notification:
10. Print automatically.
11. Display indicating alarm condition.
12. Selectable audible alarm indication.

G. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change of state, specified state, or alarm occurrence or return to normal.

H. Automatic Restart: Automatically start field equipment on restoration of power. Furnish time delay between individual equipment restart and time of day start/stop.

I. Messages:
1. Automatically display or print user-defined message subsequent to occurrence of selected events.
2. Compose, change, or delete message.
3. Display or log message at any time.
4. Assign any message to event.

J. Reports:
1. Manually requested with time and date.
2. Long term data archiving to hard disk.
3. Automatic directives to download to transportable media including floppy diskettes for storage.
4. Data selection methods to include data base search and manipulation.
5. Data extraction with mathematical manipulation.
6. Data reports to allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
7. Generating reports either normally at operator direction, or automatically under workstation direction.
8. Either manually display or print reports. Automatically print reports on daily, weekly, monthly, yearly or scheduled basis.
9. Include capability for statistical data manipulation and extraction.

10. Capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

K. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

L. Data Collection:
1. Automatically collect and store in disk files.
2. Daily electrical energy consumption, peak demand, and time of peak demand for up to electrical meters over 2-year period.
3. Daily consumption for up to 30 meters over a 2 year period.
4. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
5. Archiving of stored data for use with system supplied custom reports.

M. Graphic Display: Support graphic development on work station with software features:
1. Page linking.
2. Generate, store, and retrieve library symbols.
3. Single or double height characters.
4. Sixty (60) dynamic points of data for each graphic page.
5. Pixel level resolution.
6. Animated graphics for discrete points.
7. Analog bar graphs.
8. Display real time value of each input or output line diagram fashion.

N. Maintenance Management:
1. Run time monitoring, for each point.
2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
3. Equipment safety targets.
4. Display of maintenance material and estimated labor.
5. Target point reset, for each point.

O. Advisories:
1. Summary containing status of points in locked out condition.
2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
3. Report of power failure detection, time and date.
4. Report of communication failure with operator device, field interface unit, point and programmable control unit.

2.6 LOAD CONTROL PROGRAMS

A. General: Support inch-pounds and S.I. metric units of measurement.

B. Demand Limiting:
1. Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.

2. Input: Pulse count from incoming power meter connected to pulse accumulator in control unit.
3. Forecast demand (kW): Predicted by sliding window method.
4. Automatically shed loads throughout the demand interval selecting loads with independently adjustable on and off time of between one and 255 minutes.
5. Demand Target: Minimum of 3 for each demand meter; change targets based upon (1) time, (2) status of pre-selected points, or (3) temperature.
6. Load: Assign load shed priority, minimum "ON" time and maximum "OFF" time.
7. Limits: Include control band (upper and lower limits).
8. Output advisory when loads are not available to satisfy required shed quantity, advise shed requirements and requiring operator acknowledgment.

C. Duty Cycling:
1. Periodically stop and start loads, based on space temperature, and according to various On/Off patterns.
2. Modify off portion of cycle based on operator specified comfort parameters. Maintain total cycle time by increasing on portion of cycle by equal quantity off portion is reduced.
3. Set and modify following parameters for each individual load.
   a. Minimum and maximum off time.
   b. On/Off time in one-minute increments.
   c. Time period from beginning of interval until cycling of load.
   d. Manually override the DDC program and place a load in an On or Off state.
   e. Cooling Target Temperature and Differential.
   f. Heating Target Temperature and Differential.
   g. Cycle off adjustment.

D. Automatic Time Scheduling:
1. Self-contained programs for automatic start/stop/scheduling of building loads.
2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
3. Special day’s schedule supporting up to 30 unique date/duration combinations.
4. Number of loads assigned to time program; with each load having individual time program.
5. Each load assigned at least 16 control actions for each day with 1 minute resolution.
6. Furnish the following time schedule operations:
   a. Start.
   b. Optimized Start.
   c. Stop.
   d. Optimized Stop.
   e. Cycle.
   f. Optimized Cycle.
7. Capable of specifying minimum of 30 holiday periods up to 100 days in length for the year.
8. Create temporary schedules.
9. Broadcast temporary "special day" date and duration.

E. Start/Stop Time Optimization:
   1. Perform optimized start/stop as function of outside conditions, inside conditions, or both.
   2. Adaptive and self-tuning, adjusting to changing conditions unattended.
   3. For each point under control, establish and modify:
      a. Occupancy period.
      b. Desired temperature at beginning of occupancy period.
      c. Desired temperature at end of occupancy period.

F. Night Setback/Setup Program: Reduce heating space temperature set point or raise cooling space temperature set-point during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.

G. Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.
   1. Employ arithmetic, algebraic, Boolean, and special function operations.
   2. Treat calculated values like any other analog value; use for any function where a "hard wired point" might be used.

H. Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.
   1. Define time interval between each control action between 0 to 3600 seconds.
   2. Output may be analog value.
   3. Provide for "skip" logic.
   4. Verify completion of one action before proceeding to next action. When not verified, program capable of skipping to next action.

I. Direct Digital Control: Furnish with each control unit Direct Digital Control software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.
   1. Control loops: Defined using "modules" are analogous to standard control devices.
   2. Output: Paired or individual digital outputs for pulse width modulation, and analog outputs.
   3. Firmware:
      a. PID with analog or pulse-width modulation output.
      b. Floating control with pulse-width modulated outputs.
      c. Two-position control.
      d. Primary and secondary reset schedule selector.
      e. Hi/Low signal selector.
      f. Single pole double-throw relay.
      g. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.
   4. Direct Digital Control loop: Downloaded upon creation or on operator request. On sensor failure, program executes user defined failsafe output.
   5. Display: Value or state of each of lines interconnecting DDC modules.

J. Fine Tuning Direct Digital Control PID or floating loops:
   1. Display information:

a. Control loop being tuned.
b. Input (process) variable.
c. Output (control) variable.
d. Set-point of loop.
e. Proportional band.
f. Integral (reset) Interval.
g. Derivative (rate) Interval.

2. Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" versus "variable".

K. Trend logging:
1. Each control unit capable of storing samples of control unit's data points.
2. Update file continuously at operator assigned intervals.
3. Automatically initiate upload requests and then stores data on hard disk.
4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
5. Co-ordinate sampling with specified on/off point- state.
6. Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

2.7 HVAC CONTROL PROGRAMS

A. General:
1. Support Inch-pounds and S.I. metric units of measurement.
2. Identify each HVAC Control system.

2.8 CHILLER CONTROL PROGRAMS

A. Control function of chilled water reset. Support inch-pounds and S.I. metric units of measurement.

B. Chilled Water Reset: Automatically reset controlled chilled water temperature satisfying cooling coil requiring greatest cooling.

2.9 PROGRAMMING APPLICATION FEATURES

A. Trend Point:
1. Sample up to 50 points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month.
2. Output trend logs as line-graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:
1. Allow definition of minimum of messages, each having minimum length of characters for each individual message.

2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totaled point's warning limit, hardware elements advisories.
3. Output assigned alarm with "message requiring acknowledgment".
4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:
1. Automatically initiate equipment or system commands, based on selected time schedule for points specified.
2. Program times for each day of week, for each point, with one minute resolution.
3. Automatically generate alarm output for points not responding to command.
4. Allow for holidays, minimum of 366 consecutive holidays.
5. Operator commands:
    a. System logs and summaries.
    b. Start of stop point.
    c. Lock or unlock control or alarm input.
    d. Add, delete, or modify analog limits and differentials.
    e. Adjust point operation position.
    f. Change point operational mode.
    g. Open or close point.
    h. Enable/disable, lock/unlock, or execute interlock sequence or computation profile.
    i. Begin or end point totals.
    j. Modify total values and limits.
    k. Access or secure point.
    l. Begin or end HVAC or load control system.
    m. Modify load parameter.
    n. Modify demand limiting and duty cycle targets.
6. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

D. Interlocking:
1. Permit events to occur, based on changing condition of one or more associated master points.
2. Binary contact, high/low limit of analog point or computed point capable of being used as master. Master capable of monitoring or commanding multiple slaves.
3. Operator commands:
    a. Define single master/multiple master interlock process.
    b. Define logic interlock process.
    c. Lock/unlock program.
    d. Enable/disable interlock process.
    e. Execute terminate interlock process.
    f. Request interlock type summary.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify conditioned power supply is available to control units and to operator workstation.

B. Verify field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator workstation. Implement features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 15940.

C. Install with 120 volts alternating current, 15 amp dedicated emergency power circuit to each programmable control unit.

D. Install conduit and electrical wiring in accordance with Section 16150.

E. Install electrical material and installation in accordance with appropriate requirements of Division 16.

3.3 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow adequate time for start-up and commissioning prior to placing control systems in permanent operation.

B. Furnish service technician employed by system installer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

3.4 DEMONSTRATION AND TRAINING

A. Furnish basic operator training for two persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 40 hours instructor time. Furnish training on site.

B. Demonstrate complete and operating system to Owner.

END OF SECTION

SECTION 15940

SEQUENCE OF OPERATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:
   1. Cabinet Heaters.
   2. Rooftop air handlers
   3. Exhaust fans.
   4. Air terminal units.
   5. Hot water heating system

B. Related Sections:
   1. Section 15910 - Direct Digital Controls: For equipment, devices, system components, and software to implement sequences of operation.

1.2 SUBMITTALS

A. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
   2. Submit flow diagrams for each control system, graphically depicting control logic.
   3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
   4. Coordinate submittals with information requested in Section 15905 15910 15920.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CABINET HEATERS

A. Single temperature thermostat mounted in cabinet return air set at 68 degrees F maintains constant space temperature by cycling unit fan motor.

3.2 SEQUENCE OF OPERATION - VAV VARITRAC ROOFTOP AIR CONDITIONING UNIT

A. The central controller shall scan the terminal unit controllers to determine deviations from temperature setpoint, time of deviation, time from last changeover and number of terminal unit controllers requiring heating or cooling. Based upon this information, the system heat/cool mode and stage of capacity shall be determined.

B. The central controller shall be capable of excluding a zones request for cooling or heating if that zone remains more than 3 degrees from setpoint for a period of 60 minutes.

C. The central controller shall monitor the system supply air temperature to ensure that high and low temperature limits are maintained. The temperature limits shall be editable values.

D. The central controller shall modulate the position of the bypass damper based on a supply air duct [velocity] [pressure] input, to maintain a minimum air flow rate through the air conditioning unit. Bypass damper position and setpoints shall be available for monitoring and editing at the central controller. If bypass damper information is not available at central controller, additional equipment must be provided which will allow monitoring and editing bypass damper parameters at central controller.

E. The duct pressure sensor shall be field convertible to sense supply duct velocity or static pressure. The central controller shall be capable of modulating the position of the bypass damper based on a supply duct [velocity] [static pressure] input.

F. The central controller shall be capable of re-calibrating the supply air duct [velocity] [pressure] sensor (pressure transducer). The central controller shall be capable of commanding all terminal unit controllers to re-calibrate their damper blade position. This calibration process shall occur upon system power up, and each time the system switches from the occupied to unoccupied mode.

G. The central controller shall be capable of issuing override commands to the terminal unit controller. Override commands shall be used by the terminal unit controller to change the criteria by which the actuator and the terminal unit heat outputs are controlled. The central controller shall be capable of issuing the following override commands:
   1. Drive terminal unit damper to maximum position.
   2. Drive terminal unit damper to minimum position.
   3. Drive terminal unit damper to fully closed.
   4. Drive terminal unit damper to fully open.
   5. Disable terminal unit remote heat.

H. The central controller shall be capable of resetting the terminal unit minimum position setpoint for purposes of increasing ventilation to the space whenever the HVAC unit has no heating or cooling stages energized.

I. The central controller shall be capable of assigning terminal unit controllers into groups. Grouping shall allow for acquiring group status information and executing override commands to all unit controllers within a group at one time.

J. The central controller shall have the capability of directly controlling the operation a packaged rooftop unit with a factory installed microprocessor control board. The central

controller and the rooftop control board shall be capable of sharing data and control modes over a single pair of wires via a communications board mounted in the unit. The central controller shall automatically recognize and communicate with the rooftop unit on the communications link.

3.3 EXHAUST FANS

A. Fans to be started/stopped by the DDC system on a time of day occupancy schedule.

3.4 AIR TERMINAL UNITS

A. Single Duct Variable Volume Air Terminal Units (with Heating Coil):
   1. Occupied Cycle: On rise in space temperature above cooling setpoint, air terminal unit damper modulates open to maximum air quantity. As space temperature drops below cooling setpoint, air terminal unit damper modulates to its minimum air quantity. As space temperature continues to fall to heating setpoint, air terminal unit damper modulates to heating minimum air quantity. Heating coil controlwill modulate open heating coil control valve.
   2. Unoccupied Cycle: Air terminal damper is normally closed. Heating is staged to maintain reduced space temperature. Heating coil control valve is normally open.

3.5 SEQUENCE OF OPERATION - HOT WATER SYSTEM

A. The hot water system consists of one boiler with hot water secondary pumps and primary distribution pumps. The system operates as follows (All suggested set points and settings are adjustable.):

B. Heating Control: At the beginning of the heating season, as defined by the heating system enable point being energized (manually by the operator or by program function (i.e., Time-Of-Day)), the boiler and the circulating pumps are started. At the end of the heating season (heating system enable point is de-energized), the boiler, circulating pumps and distribution pumps are turned off.

C. If the heating system enable point is on and the outdoor air temperature is below 65° F (18° C), the primary heating distribution pumps start.

D. The supply water set point is maintained by enabling the boiler to fire under their own controls. The heating water supply set point is reset based on outdoor air temperature. When the outdoor air temperature is 20° F (-18° C), the set point is 180° F (82° C) and when the outdoor air temperature is 60° F (16°C), the set point is 140° F (60°C).

E. If a boiler goes into alarm, it is turned off and the front end is alarmed. If a pump fails, an alarm is generated and the next pump in sequence takes over.

F. The boiler control system, provided by the boiler manufacturer, is factory wired except for field installed devices (combustion air damper interlocks, flow switches, low water cut off, etc.). Flame safeguard controls are included with the boiler.

G. The DDC system uses current switches to confirm the pumps are in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control. The DDC system monitors the boiler controls for a common alarm condition (i.e. low water flow, flame failure, etc.). The DDC system generates an alarm when the water temperature is outside the minimums or maximums as required by the boiler manufacturer (i.e. differential temperature too large or too small, return or supply temperature too low, etc.).

H. Temperatures monitored include heating water supply and return and outside air.

END OF SECTION

SECTION 15950

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing adjusting, and balancing of air systems.
   2. Testing adjusting, and balancing of hydronic systems.

1.2 SUBMITTALS

A. Draft Reports: Submit for review prior to final acceptance of Project.

B. Test Reports: Submit prior to final acceptance of Project and for inclusion in operating and maintenance manuals. Assemble in soft cover, letter size, 3-ring binder, with table of contents page and tabs, and cover identification. Include reduced scale drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

C. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

D. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and Copy of NEBB Certificate of Conformance Certification.

1.3 QUALITY ASSURANCE

A. Report Forms: NEBB forms.

1.4 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience Certified by NEBB.

B. Perform Work under supervision of NEBB Certified Testing, Balancing and Adjusting Supervisor or a registered professional engineer experienced in performance of this Work and licensed in State of Colorado.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before starting work, verify systems are complete and operable.

B. Report defects, deficiencies, or abnormal conditions in mechanical systems preventing system balance.

C. Beginning of work means acceptance of existing conditions.

3.2 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets:Adjust to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.3 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to deliver design supply, return, and exhaust air quantities within previously stated tolerances.

B. Make air quantity measurements in ducts by traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Change volume using dampers mounted in ducts.

E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes to accomplish system air flow. Vary branch air quantities by damper regulation.

F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Allow for pressure drop equivalent to 50 percent loading of filters.

G. Adjust automatic outside air, return air, and exhaust air dampers for design conditions.

H. Measure temperature conditions across outside air, return air, and exhaust air dampers to check leakage.

I. At modulating damper locations, take measurements and balance at extreme conditions.

3.4 WATER SYSTEM PROCEDURE

A. Adjust water systems after air balancing to deliver design quantities within previously stated tolerances.

B. Use calibrated fittings or equipment and pressure gages to determine flow rates for system balance. Where not installed, base flow balance on temperature difference across heat transfer elements.

C. Change system balance with automatic control valves fully open to heat transfer elements.

D. Change adjustment of water distribution systems by means of balancing cocks, valves, and fittings.

3.5 FIELD QUALITY CONTROL

A. Verify recorded data represents actually measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices. Set and lock memory stops.

END OF SECTION

SECTION 16010

ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL CONDITIONS

1. The Instructions to Bidders, General Conditions, Special Conditions, Addendas, Alternates, these technical specifications and all drawings, together with the Form of Proposal and Agreement, comprise the Contract Documents for the Electrical Contract. The Electrical Contractor shall examine all of these documents prior to submitting his or her proposal.

2. The Contractor is required to read carefully the specifications for all parts of the work so as to become familiar not only with the work covered by this Section, but also that of other Divisions and Sections, including all drawings.

3. Refer to the General Requirements, Division 15 - Mechanical, as many of the general requirements stated therein are applicable to the electrical work and coordination of the two trades is covered.

4. The Contractor shall watch the progress of the work and report to the Architect immediately any cases where ample space has not been provided to accommodate his work. He must not cut through any finished work until he has received permission from the Architect. No claims for extra work will be allowed because of misinterpretation of Plans and Specifications, or due to conflict between trades for useable space.

5. The Contractor is invited to submit alternative methods or materials as a cost reduction factor, however safety and integrity of the systems must be maintained. These alternative methods or materials are not to be implemented unless written permission is provided by the Architect.

6. The General Contractor shall be responsible for all work included in this section and the delegation of work to the Electrical Contractor, shall not relieve him of this responsibility. The Electrical Contractor and his subcontractors who perform work under this section shall be responsible to the General Contractor.

7. Before submitting bid, Contractor shall visit the site and examine all adjoining existing buildings, equipment and space conditions on which his work is in any way dependent for the best workmanship and operation according to the intent of specifications and drawings. He shall report to the Architect any condition that might prevent him from installing his equipment in the manner intended. No consideration or allowance will be granted for failure to visit site, or for any alleged misunderstanding of materials to be furnished, or work to be done.

CONTENTS

1. General requirements for electrical work described herein as the following:
    - I. Scope.
    - II. Work not Included.
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VI. Submittals.
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1.1 Scope

1. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the Contractor without additional expense to the Owner.

2. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the Contractor's estimate, the same as if herein specified or shown. It is the intention of the Specifications and Drawings to call for finished work, tested, and ready for operation.

3. With submission of bid, the Electrical Contractor shall give written notice to the Architect of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, or rules; and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed the Contractor has included the cost of all required items in his proposal, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

4. Inasmuch as design for remodeling and/or rehabilitation requires that certain assumptions be made regarding existing conditions, and because some of these assumptions cannot be verified without destroying otherwise adequate or serviceable portions of the building, the Engineer cannot assure the Owner or the Contractor that the professional consulting services herein encompass all contingencies. Field coordination during construction is imperative. Contractors bidding this work must make reasonable allowances for unforeseen contingencies.

5. The electrical scope of work, in general, consists of the following:

A. Primary service cable, conduit, transformer, metering transformers, and meter will be provided by the local electric company. All connections at the transformer, if any, will be made by them. Provide new electrical service from the utility transformer, including secondary underground electrical conduit and conductors, new main electrical panel, new meter housing, new sub-fed electrical panel, and all conduits and conductors required, as shown on plans.

B. Contractor will provide primary trenching, backfill and transformer pad preparation per the electrical company specifications.

C. Branch wiring, receptacles, special outlets, switches, light fixtures, dimmers, contactors, starters, timers, etc., as shown on the plans or required for operation of the electrical system.

D. A complete conduit and raceway system, including rigid, thin-wall, flexible, sealtite and plastic conduits properly grounded to the building grounding system and/or water service piping.
E. Battery operated emergency and exit light fixtures.
F. All power and control wiring including starters, switches, contactors, relays, fuses, etc., as shown on the plans or specified herein.
G. Relocation of telephone service, and new telephone and data system backboard, as shown on the plans. Installation of outlets and cables back to service backboard.
H. Cutting and patching of holes required for the installation in concrete, wood, or masonry.
I. Repair of all damage done to the premises as a result of the installation and removal of all debris or surplus material left by those engaged in the work.
J. Complete and thorough cleaning of all equipment furnished and installed, both inside and outside, and made ready for painting by others.
K. Testing and adjusting of all equipment.
L. Provisions and installation of all bases, supports, hangers and vibration isolators for the work outlined herein.
M. Cooperation with other crafts in putting the installation in place at any time when space required is ready and the progress of the work so dictates.
N. All new outside building lighting and sign lighting shown as part of this contract, including conduit, wiring, timers, photocells, contactors and circuit breakers.

2.1 Work Not Included

1. The following work is not included in this Division unless specifically called for in individual Sections:

2. Motors and controls, unless indicated otherwise, shall be furnished by others, but shall be installed and connected by the Electrical Contractor as indicated on the drawings.

3. Telephone instruments, switches, and Service Entrance cabling shall be furnished and installed by the telephone company.

4. Controls for motors on mechanical equipment will be furnished, installed, and wired by others, unless otherwise noted on the drawings.

5. Cable television instruments, switches, and service entrance cabling shall be furnished and installed by the cable television company.

3.1 QUALITY ASSURANCE, STANDARDS AND SYMBOLS

1. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards, utility company and fire insurance carrier's requirements. Contact proper authorities, obtain and pay for required permits, inspections and utility service connections. Do not include any utility company charges that can be billed directly to the Owner.

2. In case of difference between the building codes, specifications, state laws, local ordinances, industry standards, utility company regulations, fire insurance carrier's requirements, and the contract documents, the most stringent shall govern. The Contractor shall promptly notify the Architect in writing of any such difference.

3. Noncompliance: Should the Contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, fire insurance carrier's requirements, and utility company regulations, he shall bear the cost arising in correcting any such deficiency.

4. Applicable codes and all standards shall include all state laws, local ordinances, utility company regulations and the applicable requirements of the following nationally accepted codes and standards:
Building Codes
National Building Code.
Local Building Code.
National Electrical Code.
State Electrical Code.
Local Municipal Electrical Code.
Industry Standards, Codes, and Specifications
AMCA -Air Moving and Conditioning Association.
ASHRAE - American Society of Heating, Refrigeration, and Air Conditioning Engineers.
ASME - American Society of Mechanical Engineers.
ASTM - American Society for Testing and Materials.
EIA -Electronic Industries Association.
IEEE - Institute of Electrical and Electronic Engineers.
IPCEA - Insulated Power Cable Engineers' Association.
NEC - National Electrical, Code (NFPA No. 70-1996).
NBS - National Bureau of Standards.
NEMA -National Electrical Manufacturers' Association.
NFPA - National Fire Protection Association.
USASI - United States of America Standards Institute.
UL -Underwriters' Laboratories.
Insurance Carriers
FIA - Factory Insurance Association.
FMED - Factory Mutual Engineering Division.

5. The Drawings are diagrammatic and indicate generally the locations of material and equipment. These Drawings shall be followed as closely as possible. The Electrical Contractor shall coordinate the work under this section with the architectural, structural, plumbing, heating and air conditioning, and the drawings of other trades for exact dimensions, clearances and roughing-in locations. This Contractor shall cooperate with all other trades in order to make minor field adjustments to accommodate the work of others. Do not rely on the scale of the drawings for rough-in measurements, nor use them as Shop Drawings.

6. All materials and equipment for which label service is available shall bear the label of the Underwriters' Laboratories Inc.

7. Guarantee: This Contractor shall guarantee his workmanship and material (incandescent lamps, fuses, and any existing equipment are exempt) for a period of one year from the date of final acceptance and leave his work in perfect order at completion. Should defects develop within the guarantee period, this Contractor shall, upon notice of same, remedy the defects and have all damages to other work or furnishings caused by the defects or the work of correcting same repaired and/or replaced at his expense, to the condition before such damage.

4.1 FEES AND INSPECTION CERTIFICATES

1. The Contractor shall obtain and pay for all permits and inspection services and certificates in conjunction with this work.

2. Upon completion of the work, Contractor shall obtain the approval of all recognized agencies concerned with the work, along with the approval of the National Board of Fire Underwriters, such certificates of inspection and approval from said bureau and/or agencies must be submitted to the Architect.

5.1 MATERIALS

1. Refer to Division 1 sections for general requirements on products, materials and equipment.

2. All materials shall be new, the best of their respective kinds, unless otherwise specified, and shall be installed by labor thoroughly skilled in the class of work anticipated by this Contract.

3. Provide products which are compatible with other products of the electrical work and with other work requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with other work.

4. All equipment and materials used in relation to control work for the project shall be new and shall bear the manufacturer's name and trade name. The equipment and material shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.

5. Unless otherwise indicated, all heating, ventilating, air conditioning, plumbing, and other mechanical equipment, motors, and controls shall be furnished, set in place and wired as follows:

	RESPONSIBLE DIVISION			
ITEM	FURNISHED	SET	POWER-WIRED	CONTROL-WIRED
Mechanical Equipment	15	15	16	--
Combination Magnetic Motor Starters, Magnetic Motor Starters and Contactors	15	16	16	15
Fused and Unfused Disconnect Switches, Thermal Overload Switches and Heaters, Manual Motor Starters	16(1)	16(1)	16	--
Manual-Operating and Multi-Speed Switches	15	16	16	16
Controls, Relays, Transformers	15	15	16	15
Thermostats (low voltage)				

and Time Switches	15	15	16	15
Motor and Solenoid Valves, Damper Motors, PE & EP Switches	15	15(2)	--	15(2)
Push-button Stations and Pilot Lights	15	15(2)	--	15(2)
Heating, Cooling, Ventilation and Air Conditioning Controls	15	15	16	15
Exhaust Fan Switches	15	16	16	15(2)
Fire and Smoke Detectors	16(3)	16(3)	16	16(3)

Subscript Footnotes:
1. Under Division 15 if furnished factory-wired as part of equipment or if furnished with combination starters.
2. If item is for line voltage, set in place and connect under Division 16. Where factory mounted on equipment or attached to piping or ducts and using line voltage, furnish and set under Division 15 and connect under Division 16.
3. For units mounted in or on mechanical equipment or ducts, fan shut-down connections shall be under Division 15, and all other connections under Division 16.

6.1 SUBMITTALS

1. Furnish the Architect with complete shop drawings and associated data in accordance with General Conditions, for all major elements of the Electrical work for review, checking and approval. None of the following equipment shall be fabricated, delivered, erected or connected other than from drawings officially approved by the Architect. Coordinate with subcontractors for HVAC and Plumbing work. Submit the following items as a minimum:

A. Panelboards, CT cabinets, meter housings and other switchgear.
B. Lighting fixtures, poles, dimmers, lamps, ballasts and other accessories.
C. Disconnect switches, contactors, time clocks, photocells and motor starters.
D. Toggle switches, receptacles, special outlets and cover plates.
E. Large junction boxes, pull boxes, wireway, gutter, surface raceway and fittings.
F. Fire alarm system control panel, smoke detectors, heat detectors, horns and combination horn/strobes, pull stations, duct detectors, digital dialer and other system components.
G. Telephone jacks, face plates, cabling, patch panels and other system components.
H. Computer jacks, face plates, cabling, patch panels and other system components.

2. The Electrical Contractor shall furnish and present six (6) copies of shop drawings or brochures for all fixtures, equipment, and accessories to the Architect for the Engineer's approval.

3. The Electrical Contractor shall furnish and present six (6) copies of a schedule of manufacturers of all materials for which shop drawings or brochures are not presented. No equipment shall be ordered, purchased, or installed prior to approval of the shop drawings,

brochures, and schedules. Checking is only for general conformance with the design concept of the project and general compliance shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

7.1 SUBSTITUTION OF MATERIALS

1. In general, the contract drawings and specifications show and describe arrangements suitable for the specific items of equipment either named or described. In the event that Contractor submits for approval, and receives such approval, for a device or piece of equipment which requires connections or arrangements of these services differing from those indicated or described in the contract documents, Contractor shall give timely notice and shall make suitable alterations in the work to accommodate the substitute equipment, and shall be responsible for any and all additional costs incurred by virtue of the substitution of such equipment for the equipment named or described in the contract documents.

2. The naming of a certain brand or make or manufacturer in the specifications is to establish a quality standard for the article desired. The Contractor is not restricted to the use of the specific brand of the manufacturer named unless so indicated in the specifications. However, where a substitution is requested, a substitution will be permitted only with the written approval of the Architect. Request for such substitutions shall be submitted in triplicate to the Architect at least five working days prior to the Bid Opening date. Requests, as such, shall be accompanied by Manufacturer's Data Sheets and other information in the opinion of the Architect that is necessary for review. No substitute material or equipment shall be ordered, fabricated, shipped or processed in any manner prior to the approval of the Architect. The Contractor shall assume all responsibility for additional expenses as required in any way to meet changes from the original material or equipment specified.

8.1 TEMPORARY POWER AND LIGHTING

1. The Electrical Contractor shall be responsible for all arrangements and costs for providing temporary electrical metering, main switches, and distribution panels at the site as required for construction purposes. The distribution panels shall be located at a central point designated by the Architect. The General Contractor shall indicate prior to installation whether three phase or single-phase service is required.

2. The Electrical Contractor shall furnish and install a minimum of one OSHA approved pigtail socket with 150-watt lamp for every 500 square feet of floor space, evenly distributed throughout the building. Temporary lighting should provide a minimum of 5 footcandles for safe and adequate working conditions throughout the project.

3. The Electrical Contractor shall furnish and install as a minimum power outlets to total one for every 2000 square feet or part thereof of floor area and these shall be 15- or 20-amp, single-phase receptacles for either 110 or 220 volts as directed by the General Contractor. Also provide power for temporary heating and ventilating of storage and construction buildings.

4. Any light or power outlets required over the maximum quantity noted above shall be paid for by the Contractor requiring the same. The power consumption shall be paid for by the General Contractor.

5. Installation

A. Install work in neat and orderly manner.
B. Make structurally and electrically sound throughout.
C. Maintain to give continuous service and to provide safe working conditions.
D. Modify and extend service as work progress requires.
E. Locate so that power is available at any desired point with no more than 100 ft. (30.00 m) extension, and with no more than 5% voltage drop at full load.
F. Provide circuit breaker protection for each outlet with ground fault interrupting capacity.
G. Provide equipment grounding continuity for entire system.
H. Completely remove temporary materials and equipment upon completion of construction. Repair damage caused by installation, and restore to specified or original condition.

9.1 ELECTRICAL DRAWINGS

1. The Drawings are diagrammatic and indicate generally the locations of material and equipment. These Drawings shall be followed as closely as possible. The Electrical Contractor shall coordinate the work under this section with the architectural, structural, plumbing, heating and air conditioning, and the drawings of other trades for exact dimensions, clearances and roughing-in locations: This Contractor shall cooperate with all other trades in order to make minor field adjustments to accommodate the work of others. Do not rely on the scale of the drawings for rough-in measurements, nor use them as Shop Drawings.

2. The Drawings and Specifications are complementary, each to the other, and the work required by either shall be included in the Contract as if called for by both.

3. If directed by the Architect, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

4. Electrical symbols used on this project are shown in a Symbol List on the accompanying working drawings. This list shows standard symbols and all may not appear on the project drawings. However, wherever the symbol on project drawings occurs, the item shall be provided and installed.

5. Conductor and conduit sizes are shown on the drawings in an equipment schedule for equipment and in the one line diagram for electrical distribution. Unless otherwise noted all other power and lighting circuits shall be 1/2" conduit with 2#12(CU, THHN). In any case, minimum sizes for wire and conduit shall comply with all applicable codes.

6. Major equipment of the system is located on the floor plans and the interconnection conduit and wiring is included in the one-line diagrams.

7. The drawings are indicative of the work to be installed, but do not show all bends, fittings, boxes and specialties required to complete the installation.

8. All conduits, wires, outlet boxes, switches, receptacles, devices and fixtures shall be included in the work.

9. The Electrical Contractor shall note that all items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the drawings and as required for complete systems.

10. Where it is stated that the contractor shall "provide" a device or piece of equipment, it shall mean that such devices or equipments are furnished and installed.

10.1 COORDINATION

1. General: Refer to the Division 1 sections for general coordination requirements applicable to the entire work. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the electrical work, and in its interface with other work including utilities and mechanical work, and that such establishment is the exclusive responsibility of the Contractor. Install the wiring and equipment at such times and in such manner as will in no way retard progress or completion of the project. Arrange electrical work in a neat, well organized manner with conduit and similar services running parallel with primary lines of the building construction, and with a minimum of 7'0" overhead clearance where possible. Locate operating and control equipment properly to provide easy access and arrange entire electrical work with adequate access for operation and maintenance. Advise other trades of openings required in their work for the subsequent move-in of large units of electrical work (equipment).

2. The layout of wiring on the small scale drawings shall not be considered absolute. The design shall be subject to such revisions as may be necessary to overcome building obstructions. No changes shall be made in outlet locations without the written consent of the Architect.

3. Examine the Architectural Drawings and details for the placement of all outlets to properly coordinate them with relation to cabinets, tables, benches, structural panels, trims, moldings, etc. Examine all other shop drawings, catalog cuts, etc., for special apparatus which may be roughed-in and to which connections must be made. Outlets, apparatus and connections thereto which are improperly located through failure to follow the above instructions, shall be subject to correction and/or relocation without extra charge to the Owner.

4. Coordination Drawings: For locations where several elements of electrical (or combined mechanical and electrical) work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings (shop drawings) showing the actual physical dimensions (at accurate scale) required for the installation. Prepare and submit coordination drawings prior to purchase-fabrication-coordination.

11.1 SLEEVES, INSERTS, FASTENINGS, SUPPORTS, CUTTING AND PATCHING

1. The Electrical Contractor shall provide and install metallic supports as required for the proper installation of raceway systems and all other equipment installed under this division of the contract conforming to the latest edition of the NEC.

2. Conduit shall be supported on approved types of wall brackets, ceiling trapezes, strap hangers or pipe supports. All fastenings, supports, clamps and anchors, etc., shall be of type made for the purpose. For hollow tile, or lath construction, toggle or machine bolt fastenings shall be used. For structural iron use machine screws and for solid masonry use metallic expansion shields and

machine screws. For wood or materials of similar fibrous nature, lag screws or bolts shall be employed. Screws with wooden plugs or anchors will not be accepted on any of the work. Studs and fasteners implanted in solid masonry by power actuated devices will be acceptable if precautions are taken to prevent spalling. The use of insulated wire shall not be acceptable as an attaching means for conduit or other equipment.

3. Conduit shall be securely fastened to all sheet metal outlets, junction and pull boxes with two galvanized locknuts and bushing, care being taken to see that the full number of threads project through, to permit the bushing to be drawn tight against the end of the conduit, after which the locknuts shall be made tight sufficiently to draw them into firm electrical contact with the outlet box. Install a plastic bushing on end of conduits stubbed into ceiling spaces to protect cabling.

4. The Electrical Contractor shall be responsible for all concrete pads, supports, piers, bases, foundations, and encasement required for the electrical equipment and conduit. The concrete pads for the electrical equipment shall be six inches larger all around than the base of the equipment unless specifically indicated otherwise.

5. Obtain written approval of the Architect before notching, boring, chipping, burning, drilling, welding to structural members.

6. Furnish and install all sleeves which are required to protect equipment or which may be necessary to facilitate its installation. Sleeves used in conjunction with formed concrete shall be located where required and approved by the Architect. Provide "Flameseal" or other approved fire stopping material at all penetrations through rated walls, floors and ceilings.

7. Provide and install all inserts required for equipment. Inserts shall be cast iron or cast steel of slotted type to receive a machine bolt head or nut, after installation. Be responsible for the proper spacing of inserts and their alignment and preservation before and during construction.

8. The subcontractor for this Section shall give the General Contractor complete information as to the size, position and arrangement of conduits, cabinets, boxes, etc., requiring openings in floors, walls, etc., so openings may be provided as construction progresses. Refer to General Conditions, Article "Openings, Channels, Cutting, Etc." Cutting and channeling shall be by Electrical Contractor; patching will be done by General Contractor.

9. All conduit and outlet installations and cutting of any kind must be done with great care so as not to leave unsightly surfaces which may not be entirely concealed by plates, escutcheons or other normal concealing construction. If such unsightly conditions occur, Contractor will be required, at his own expense, to replace the damaged construction.

10. Provide nail guards on both sides of studs to protect Type NM cable runs.

12.1 SCAFFOLDING

1. Furnish and erect all scaffolding, ladders, etc., required in the installation of wiring, equipment and fixtures.

13.1 TRENCHING AND BACKFILLING

1. Perform all trenching and backfill required by work under this division of the specifications. Trenching and backfilling shall be done in accordance with the "Site Work" division of the specifications and as herein specified. This portion of the work shall be executed under the direct supervision of the General Contractor. Trenches shall be excavated to the depth required for the utilities involved. The trench bottom shall be graded true and free from debris, stones and soft spots. Where direct burial cables are used, four inches of fine sand shall be placed in the bottom of the trench prior to cable placement.

2. Refer to specification section 16075 for information regarding the marking of underground conduit with marker tape.

14.1 TESTING, ADJUSTING AND CLEANING

1. As soon as electric power is available and connected to serve the equipment in the building, and everything is ready for final testing and placing in service, a complete operational test shall be made in the presence of the Architect. The Contractor shall furnish all necessary instruments and equipment, and make all tests, adjustments, and trial operations required to place the system in balanced and satisfactory operating condition, and he shall pay all professional engineering fees required in such testing. Data on all tests shall be submitted to the Architect. Furnish all necessary assistance and instructions to properly instruct the Owner’s authorized personnel in the operation and care of the system.

2. The voltage levels between the different phases shall be balanced to within 5% of each other. A recording meter shall be used to measure simultaneously the voltages from phase to phase, and phase to neutral, for a continuous period of not less than 24 hours. The printed results of this test shall be forwarded to the Architect for review. The Electrical Contractor shall be responsible for making any circuiting changes deemed necessary by the Architect in order to maintain the balanced voltage levels under normal operating conditions.

3. Prior to testing the system, the feeders and branch circuits shall be continuous from main feeders to main panels, to sub-panels, to outlets, with all breakers and fuses in place. The system shall be tested free from shorts and grounds.

4. No circuits shall be energized without the Owner’s approval.

5. The right is reserved to inspect and test any portion of the equipment and/or materials during the progress of its erection. The Contractor shall further test all wiring and connections for continuity and grounds before connecting any fixtures or equipment.

6. The Contractor shall test the entire system in the presence of the Architect or his engineer when the system is finally completed to insure that all portions are free from short circuits or ground faults.

7. The Electrical Contractor shall provide the Architect with certification of the inspection and approval of an active member of the International Association of Electrical Inspectors of all work completed and included in the section, if required. The Contractor shall be responsible for notifying the Inspector when work reaches inspection stage.

8. The Electrical Contractor shall be responsible for notifying the local fire authority having jurisdiction in order that local inspection may be carried out at the proper stage for fire alarm system and installed components.

9. The Electrical Contractor shall pay for all permits, inspection fees, and installation fees as required to complete the work under this Section of the Contract.

10. This Contractor shall guarantee the materials and workmanship for a period of twelve (12) months from the time the installation is accepted by the Owner. If, during this time, any defects should show up due to any defective materials, workmanship, negligence or want of proper care on the part of this Contractor, he shall furnish any new materials as necessary, repair said defects, and put the system in order at his own expense on receipt of notice of such defects from the Architect. This specification is not intended to imply that the Electrical Contractor shall be responsible for negligence of the Owner.

11. Upon completion of the work, all component parts, both singularly and as a whole, shall be adjusted and left in satisfactory condition. All parts of the installation, including lighting fixtures, panelboards, etc., shall be cleaned, dusted or washed and adjusted to the satisfaction of the Architect.

15.1 AS-BUILT DRAWINGS

1. Contractor shall keep an accurate record of all deviations from contract drawings and specifications. He shall neatly and correctly enter in colored ink or pencil any deviations on drawings affected, and shall keep drawings available for inspection.

2. At the completion of the job, and before final acceptance, the Contractor shall provide to the Architect two complete sets of electrical prints marked to show the work "as-built". The Contractor shall show modifications to locations for all major electrical devices, including panelboards and all major runs of conduit, the circuiting of each fixture, outlet, etc., shall be shown. Certify to the accuracy of each print, by signature and date thereon, and deliver same to Architect. Drawings shall be reproducibles.

16.1 OPERATION AND MAINTENANCE MANUALS

1. Contractor shall prepare, assemble and submit three (3) copies of an Operation and Maintenance Manual for the electrical system as installed.

2. Operation and Maintenance manuals shall be typed and bound in a hard cover, three ring binder or equivalent protection, and shall contain as a minimum the following:

A. Shop drawings or catalog product literature of all material listed in paragraph 1.08 Submittals.
B. Wiring diagrams and instructions for fire alarm system, contactors, motor starters and time clocks.
C. Control drawings for any systems not furnished under other contracts.
D. Maintenance instructions for all equipment furnished under this contract.
E. Table of equipment listing motor starter sizes, overload sizes, and fuse sizes.

3. Table of light fixtures listing manufacture and model number; lamp type, manufacture and model number; ballast type, manufacture and model number.

4. A list of contacts with phone numbers for all systems for Owners' use, in the event the electrical system requires service work within the Warranty period.

5. Copy of Certificate of Acceptance from the Electrical Inspector, Fire Marshall and any other applicable authorities.

6. Copy of Warranty Letter from Electrical Contractor and appropriate sub-contractors.

END OF SECTION 16010

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes grounding electrodes and conductors; bonding methods and materials; conduit and equipment supports, anchors and fasteners; and nameplates and wire markers.

1.2 SYSTEM DESCRIPTION

A. Grounding systems use metal underground pipe metal frame of building and driven ground rod as grounding electrodes. Grounding system connections use exothermic welds.

B. Select materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and raceway, including weight of wire and cable in raceway. Anchor and fasten electrical products to building elements and finishes as follows:
   1. Concrete Structural Elements: Expansion anchors and preset inserts.
   2. Steel Structural Elements: Beam clamps, and welded fasteners.
   3. Concrete Surfaces: Self-drilling anchors and expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Toggle bolts and hollow wall fasteners.
   5. Solid Masonry Walls: Expansion anchors and preset inserts.
   6. Sheet Metal: Sheet metal screws.
   7. Wood Elements: Wood screws.

C. Identify Electrical components as follows:
   1. Nameplate for each electrical distribution and control equipment enclosure.
   2. Wire marker for each conductor at panelboard gutters, pull boxes, and outlet and junction boxes.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s catalog data for grounding electrodes and connections; for fastening components; and nameplates, labels, and markers.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
   1. Cooper Power Systems.
   2. Substitutions: Permitted.

B. Product Description: Copper or copper-clad steel, 3/4 inch diameter rod electrode, 10 feet in length.

2.2 NAMEPLATES

A. Product Description: Engraved three-layer laminated plastic nameplate, black letters on white background.

B. Letter Size:
1. 1/8 inch letters for identifying individual equipment and loads.
2. 1/4 inch letters for identifying grouped equipment and loads.

2.3 WIRE MARKERS

A. Product Description: tubing type wire markers with circuit or control wire number permanently stamped or printed.

2.4 MATERIALS

1. Refer to Division 1 sections for general requirements on products, materials and equipment.

2. All materials shall be new, the best of their respective kinds, unless otherwise specified, and shall be installed by labor thoroughly skilled in the class of work anticipated by this Contract.

3. Provide products which are compatible with other products of the electrical work and with other work requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with other work.

4. All equipment and materials used in relation to control work for the project shall be new and shall bear the manufacturer’s name and trade name. The equipment and material shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.

2.5 INSTALLATION

A. Install 3/4" x 10' rod electrodes at locations indicated.

B. Fabricate supports from structural steel or formed steel members.

C. Install sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

D. Install nameplate parallel to equipment lines. Secure nameplate to equipment front using screws or rivets.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Wire.
   3. Mechanical connectors.
   4. Exothermic connections.

B. Related Sections:
   1. Concrete Reinforcement: Bonding or welding bars when reinforcing steel is used for electrodes.
   2. Section 13100 - Lightning Protection: Grounding of lightning protection system.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
   2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
   1. Metal underground water pipe.
   2. Metal building frame.
   3. Concrete-encased electrode.
   4. Rod electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures:.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Perform Work in accordance with State Municipality of Highways Public Work's standard.

C. Maintain one copy copies of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum years documented experience approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. O-Z Gedney Co.
5. Thomas & Betts, Electrical.
6. Substitutions: Are Permitted.

B. Product Description:
1. Material: Copper-clad steel Copper.
2. Diameter: 3/4 inch.
3. Length: 10 feet.

C. Connector: U-bolt clamp.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 2 AWG.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

2.3 MECHANICAL CONNECTORS

A. Manufacturers:
1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc. Model.
4. ILSCO Corporation Model
5. O-Z Gedney Co.
6. Thomas & Betts, Electrical

7. Substitutions: Are Permitted.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Apache Grounding/Erico Inc.
2. Cadweld, Erico, Inc.
3. Copperweld, Inc.
4. ILSCO Corporation
5. O-Z Gedney Co.
6. Thomas & Betts, Electrical
7. Substitutions: Are Permitted

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 INSTALLATION

A. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

B. Install grounding and bonding conductors concealed from view.

C. Install grounding electrode conductor and connect to reinforcing steel in foundation footing. Electrically bond steel together.

D. Bond together metal siding not attached to grounded structure; bond to ground.

E. Install grounding and bonding in patient care areas to meet requirements of NFPA 99.

F. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Bond to lightning protection system. Refer to Section 13100.

H. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

I. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

J. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.

K. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

L. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

M. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.4 FIELD QUALITY CONTROL

A. Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground resistance testing in accordance with IEEE 142.

E. Perform leakage current tests in accordance with NFPA 99.

F. Perform continuity testing in accordance with IEEE 142.

G. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION

SECTION 16075

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Labels.
   3. Wire markers.
   4. Conduit markers.
   5. Stencils.
   6. Underground Warning Tape.
   7. Lockout Devices.

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures:

B. Product Data:
   1. Submit manufacturer’s catalog literature for each product required.
   2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALIFICATIONS

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

B. Install labels nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
1. Brady.
2. Substitutions: Are Permitted.

B. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

C. Letter Size:
1. 1/8 inch high letters for identifying individual equipment and loads.
2. 1/4 inch high letters for identifying grouped equipment and loads.

D. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

A. Manufacturers:
1. Brady.
2. Substitutions: Are Permitted.

B. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.3 WIRE MARKERS

A. Manufacturers:

1. Brady.
2. Substitutions: Are Permitted.

B. Description: tubing type wire markers.

C. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
2. Control Circuits: Control wire number as indicated on shop drawings.
3. :

2.4 UNDERGROUND WARNING TAPE

A. Manufacturers:
1. Brady.
2. Substitutions: Are Permitted.

B. Description: 4 inch wide plastic tape, colored yellow with suitable warning legend describing buried electrical lines.

2.5 LOCKOUT DEVICES

A. Lockout Hasps:
1. Manufacturers:
a. Brady.
b. Substitutions: Are Permitted.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09900 for stencil painting.

3.2 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
4. Secure nameplate to equipment front using screws, rivets, or adhesive.
5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
6. Install nameplates for the following:
a. Switchboards.

b. Panelboards.
c. Transformers.
d. Service Disconnects.

C. Label Installation:
1. Install label parallel to equipment lines.
2. Install label for identification of individual control device stations.
3. Install labels for permanent adhesion and seal with clear lacquer.

D. Wire Marker Installation:
1. Install wire marker for each conductor at, pull boxes, outlet and junction boxes, and each load connection.
2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
3. Install labels at data outlets identifying patch panel and port designation.

E. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 16100

WIRING METHODS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building wire and cable, conduit and tubing, surface raceway, boxes, wiring devices, wiring connectors, and connections.

1.2 SYSTEM DESCRIPTION

A. Wiring Products:
   1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
   2. Stranded conductors for control circuits.
   3. Conductor not smaller than 12 AWG for power and lighting circuits.
   4. Conductor not smaller than 16 AWG for control circuits.
   5. 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

B. Wiring Methods:
   1. Concealed Dry Interior Locations: Building wire, Type THHN/THWN insulation, in raceway.
   2. Exposed Dry Interior Locations: Building wire, Type THHN/THWN insulation, in raceway.
   3. Above Accessible Ceilings: Building wire, Type THHN/THWN insulation, in raceway.
   4. Wet or Damp Interior Locations: Building wire, Type THHN/THWN insulation, in raceway.
   5. Exterior Locations: Building wire, Type THHN/THWN insulation, in raceway.
   6. Underground Locations: Building wire, Type THHN/THWN insulation, in raceway.

C. Conductor sizes are based on copper.

D. Raceway and boxes are located as indicated on Drawings, and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

E. Raceway Products:
   1. Underground More than 5 Feet outside Foundation Wall: Use thin-wall nonmetallic conduit. Use cast metal boxes or nonmetallic handhole.
   2. Underground Within 5 Feet outside Foundation Wall: Use, thickwall nonmetallic conduit. Use cast metal boxes.
   3. In or Under Slab on Grade: Use thin-wall nonmetallic conduit. Use cast metal boxes.
   4. Outdoor Locations, Above Grade: Use rigid steel conduit. Use cast metal outlet, pull, and junction boxes.
   5. In Slab Above Grade: Use, electrical metallic tubing. Use sheet metal boxes.

6. Wet and Damp Locations: Use, electrical metallic tubing. Use cast metal or nonmetallic outlet, junction, and pull boxes. Use flush mounting outlet box in finished areas.
7. Concealed Dry Locations: Use, electrical metallic tubing. Use sheet-metal boxes. Use flush mounting outlet box in finished areas. Use hinged enclosure for large pull boxes.
8. Exposed Dry Locations: Use, electrical metallic tubing. Use sheet-metal boxes. Use flush mounting outlet box in finished areas. Use hinged enclosure for large pull boxes.

F. Minimum Raceway Size: 1/2 inch unless otherwise specified.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's catalog information for each wiring device.

1.4 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 SURFACE METAL RACEWAY

A. Manufacturers:
1. Wire Mold Model G4000.
2. Substitutions: Permitted.

B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway, with manufacturer’s standard enamel finish. Furnish manufacturer's standard accessories; match finish on raceway.

2.2 WALL SWITCHES

A. Single Pole Switch:
1. Leviton Model 1221-2 .
2. Substitutions: Permitted.

B. Double Pole Switch:
1. Leviton Model 1222-2.
2. Substitutions: Permitted

C. Three-way Switch:
1. Leviton Model 1223-2.
2. Substitutions: Permitted.

D. Motion Switch:
   1. Leviton Model ODS10-ID.
   2. Substitutions: Permitted.

E. Motion Switch Dual Level Office :
   1. Wattstopper Model PW-200-LA.
   2. Substitutions: Permitted

F. Color: by Architect.

2.3 WALL DIMMERS

A. Manufacturers:
   1. Leviton Model MLX06-1LW
   2. Substitutions: Permitted.

B. Product Description: Semiconductor dimmer for fluorescent lamps with ON-OFF switch independent of brightness setting.

C. Body and Handle: Plastic with linear slide. Color by Architect

D. Voltage: 120/ 277 volts.

2.4 RECEPTACLES

A. Single Convenience Receptacle:
   1. Leviton Model 5361.
   2. Substitutions: Permitted.

B. Duplex Convenience Receptacle:
   1. Leviton Model 5362.
   2. Substitutions: Permitted.

C. GFCI Receptacle:
   1. Leviton Model 6899.
   2. Substitutions: Permitted.

D. Color: by Architect.

2.5 WALL PLATES

A. Manufacturers:
   1. Leviton Model 8400.
   2. Substitutions: Permitted.

B. Decorative Cover Plate: Satin Finish stainless steel.

C. Jumbo Cover Plate: Satin Finish stainless steel.

D. Weatherproof Cover Plate: Stainless steel plate with hinged and gasketed device cover.

2.6 MULTIOUTLET ASSEMBLY

A. Manufacturers:
   1. Wiremold Model G4000.
   2. Substitutions: Permitted.

B. Multioutlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multioutlet assembly. Furnish manufacturer’s standard enamel finish.

C. Receptacles: NEMA WD 6, type 5-15R, single receptacle.

D. Receptacle Spacing: 18 inches on center.

E. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes, and connectors.

PART 3 EXECUTION

3.1 INSTALLATION

A. Route raceway and cable to meet Project conditions.

B. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

C. Adjust box location up to 10 feet prior to rough-in when required to accommodate intended purpose.

D. Do not install flush mounting box back-to-back in walls; install boxes with minimum 24 inches separation.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; multioutlet assembly; and device plates and decorative box covers.

B. Related Sections:
1. Section 16141 - Floor Boxes: Service fittings for receptacles installed on floor boxes.
2. Section 16141 - Floor Boxes: Poke-through receptacles.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

PART 2 PRODUCTS

WALL SWITCHES

A. Manufacturers:
1. Arrow Hart Wiring Devices
2. Eagle Electric.
3. Siemens Co..
4. Leviton.
5. Model.

6. Substitutions: Section 01600 - Product Requirements.

B. Product Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.

C. Body and Handle: Color by Architect, plastic with toggle handle.

D. Indicator Light: Lighted handle type switch; red color handle.

E. Locator Light: Lighted handle type switch; red color handle.

F. Ratings:
1. Voltage: 120-277 volts, AC.
2. Current: 20 amperes.

G. Ratings: Match branch circuit and load characteristics.

2.2 WALL DIMMERS

A. Manufacturers:
1. Lutron.
2. Eagle Electric.
3. Leviton
4. Substitutions:Permitted.

B. Product Description: NEMA WD 1; Semiconductor dimmer for incandescent lamps, Type in schedule.

C. Body and Handle: Color by Architect, plastic with linear slide.

D. Voltage: 120/277 volts.

E. Power Rating: 1000 watts.

F. Accessory Wall Switch: Match dimmer appearance.

2.3 RECEPTACLES

A. Manufacturers:
1. Arrow Hart Wiring Devices.
2. Leviton.
3. Siemens Co.
4. Substitutions: Permitted.

B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.

C. Device Body: Color by Architect, plastic.

D. Configuration: NEMA WD 6, type.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.4 WALL PLATES

A. Manufacturers:
1. Arrow Hart Wiring Devices Model.
2. Leviton.
3. Siemens Co. Model.
4. Substitutions: Permitted.

B. Decorative Cover Plate: 302 stainless steel.

C. Jumbo Cover Plate: Satin Finish 302 stainless steel.

D. Weatherproof Cover Plate: Stainless steel plate with hinged and gasketed device cover.

2.5 MULTIOUTLET ASSEMBLY

A. Manufacturers:
1. Arrow Hart Wiring Devices.
2. Wiremold.
3. Siemens Co. Model.
4. Substitutions: Permitted.

B. Multi-outlet Assembly: Sheet metal channel with fitted cover, suitable for use as multi-outlet assembly.

C. Size:As indicated on Drawings.

D. Receptacles: Furnish covers and accessories to accept convenience receptacles specified in this Section.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on bottom.

F. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

I. Use jumbo size plates for outlets installed in masonry walls.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Install wall switch 48 inches above finished floor.

B. Install convenience receptacle 18 inches above finished floor.

C. Install convenience receptacle 6 inches above counter.

D. Install dimmer 48 inches above finished floor.

E. Coordinate installation of wiring devices with underfloor raceway service fittings provided under Section 16136.

F. Coordinate installation of wiring devices with floor box service fittings provided under Section 16141.

3.5 FIELD QUALITY CONTROL

A. Section: Field inspecting, testing, adjusting, and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Section 01700 - Execution Requirements:Testing, adjusting, and balancing.

B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 16150

WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Submittal procedures.

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 ADJUSTING

A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION

SECTION 16235

ENGINE GENERATORS

1. GENERAL

a. SUMMARY

i. Section includes engine generator set, exhaust silencer and fittings, transfer switch, fuel fittings, remote control panel, battery, and charger.

ii. Related Sections:
(1) Section 15071 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
(2) Section 15182 - Internal-Combustion Engine Exhaust Piping.
(3) Section 16060 - Grounding and Bonding for Electrical Systems.
(4) Section 16075 - Identification for Electrical Systems.
(5) Section 16413 - Enclosed Transfer Switches.

b. REFERENCES

i. National Electrical Manufacturers Association:
(1) NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
(2) NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
(3) NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.
(4) NEMA MG 1 - Motors and Generators.

ii. International Electrical Testing Association:
(1) NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

iii. National Fire Protection Association:
(1) NFPA 30 - Flammable and Combustible Liquids Code.
(2) NFPA 110 - Standard for Emergency and Standby Power Systems.

c. SYSTEM DESCRIPTION

i. Description: Engine generator assembly and accessories to provide source of power for Level 2 applications in accordance with NFPA 110.

ii. Capacity: 60 kW, 75 kVA at elevation of 4500 feet above sea level, standby rating using specified engine cooling scheme.

d. SUBMITTALS

i. Submittal Procedures: Submittal procedures.

ii. Shop Drawings: Indicate electrical characteristics and connection requirements. Include plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection diagrams.

iii. Product Data: Submit data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, transfer switch, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, and remote radiator.

iv. Test Reports: Indicate results of performance testing.

v. Manufacturer's Field Reports: Indicate inspections, findings, and recommendations.

e. CLOSEOUT SUBMITTALS

i. Operation and Maintenance Data: Submit instructions and service manuals for normal operation, routine maintenance, oil sampling and analysis for engine wear, and emergency maintenance procedures.

f. QUALIFICATIONS

i. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience, and with service facilities within 100 miles of project.

ii. Supplier: Authorized distributor of specified manufacturer with minimum three years experience.

g. WARRANTY

i. Execution Requirements: Product warranties and product bonds.

ii. Furnish five year manufacturer warranty.

h. MAINTENANCE SERVICE

i. Execution Requirements: Maintenance service.

ii. Furnish service and maintenance of engine generator and transfer switch for one year from Date of Substantial Completion.

i. MAINTENANCE MATERIALS

i. Furnish one set of tools required for preventative maintenance of engine generator system. Package tools in adequately sized metal tool box.

ii. Furnish two of each fuel, oil and air filter element.

2. PRODUCTS

a. SERVICE CONDITIONS

i. Temperature: 105 degrees F

ii. Altitude: 4500 feet.

b. ENGINE

i. Manufacturers:
(1) Cummins Co. Model DFGB.
(2) Substitutions: Permitted.

ii. Product Description: Water-cooled in-line or V-type, four-stroke cycle, spark ignition natural gas internal combustion engine.

iii. Rating: Sufficient to operate under 10 percent overload for one hour in ambient of 104 degrees F at elevation of 4500 feet

iv. Fuel System: Natural Gas.

v. Engine speed: 1800 rpm.

vi. Safety Devices: Engine shutdown on high water temperature, low oil pressure,

overspeed, and engine overcrank. Limits as selected by manufacturer.

vii. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Furnish remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.

viii. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 120 volts AC.

ix. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F Radiator air flow restriction 0.5 inches of water maximum.

x. Engine Accessories: Lube oil filter, intake air filter, lube oil cooler, gear-driven water pump. Furnish water temperature gage, and lube oil pressure gage on engine/generator control panel.

xi. Mounting: Furnish unit with suitable spring-type vibration isolators and mount on structural steel base.

c. GENERATOR

i. Manufacturers:
(1) Cummins Power Co. Model GGHB.
(2) Substitutions: Permitted.

ii. Product Description: NEMA MG1, three phase, four pole, reconnectable brushless synchronous generator with brushless exciter.

iii. Rating: 60 kW, 75 kVA, at 0.8 power factor, 208Y/120 volts, 60 Hz at 1800 rpm.

iv. Insulation Class: F.

v. Temperature Rise: 105 degrees C Continuous.

vi. Enclosure: NEMA MG1, open drip proof.

vii. Voltage Regulation: Furnish generator mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Furnish manual controls to adjust voltage drop, voltage level (plus or minus 5 percent) and voltage gain.

d. GOVERNOR

i. Manufacturers:
(1) Cummins Power. Model GGHB.
(2) Substitutions: Permitted.

ii. Product Description: Electronic governor to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes.

e. AUTOMATIC TRANSFER SWITCH

i. Manufacturers:
(1) ONAN. Model OT III.
(2) Substitutions: Permitted.

ii. Product Description: NEMA ICS 10, automatic transfer switch.

iii. Configuration: Electrically operated, mechanically held transfer switch.

iv. Interrupting Capacity: 100 percent of continuous rating.

v. Withstand Current Rating: 65,000 rms symmetrical amperes, when used with molded case circuit breaker.

vi. Control Features and Functions:

(1) Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, switch position.
(2) Test Switch: Mount in cover of enclosure to simulate failure of normal source.
(3) Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.
(4) Transfer Switch Auxiliary Contacts: 1 normally open; 1 normally closed.
(5) Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.
(6) Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.
(7) In-Phase Monitor: Inhibit transfer until source and load are within 5

electrical degrees.

(8) Switched Neutral: Overlapping contacts.

vii. Automatic Sequence of Operation:

(1) Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
(2) Time Delay To Start Alternate Source Engine Generator: 0 to 15 seconds, adjustable.
(3) Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
(4) Time Delay Before Transfer to Alternate Power Source: 2 to120 seconds, adjustable.
(5) Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
(6) Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.

viii. Time Delay Before Engine Shut Down: 0 to 10 minutes, adjustable, of unloaded operation.

ix. Engine Exerciser: Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control when normal source fails during exercising period.

x. Alternate System Exerciser: Transfer load to alternate source during engine exercising period.

xi. Enclosure:
(1) Enclosure: ICS 10, Type 12.
(2) Finish: Manufacturer's standard gray enamel.

f. ACCESSORIES

i. Exhaust Silencer: Residential type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.

ii. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, 170 ampere-hours minimum capacity. Match battery voltage to starting system. Furnish cables and clamps.

iii. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

iv. Battery Charger: Current limiting type designed to float at 2.17 volts for each cell and equalize at 2.33 volts for each cell. Furnish overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Furnish wall mounted enclosure to meet NEMA 250, Type 1 requirements.

v. Line Circuit Breaker: NEMA AB 1, molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole. Furnish battery voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in enclosure to meet NEMA 250, Type 1 requirements.

vi. Engine-Generator Control Panel: NEMA 250, Type 1 generator-mounted control panel enclosure with engine and generator controls and indicators. Furnish provision for padlock and the following equipment and features:
   (1) Frequency Meter: 45-65 Hz. range, 3.5 inch dial.
   (2) AC Output Voltmeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   (3) AC Output Ammeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   (4) Output voltage adjustment.
   (5) Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
   (6) Engine start/stop selector switch.
   (7) Engine running time meter.
   (8) Oil pressure gage.
   (9) Water temperature gage.
   (10) Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
   (11) Additional visual indicators and alarms in accordance with by NFPA 110.
   (12) Remote Alarm Contacts: Factory wire SPDT contacts to terminal strip for remote alarm functions in accordance with NFPA 110.

vii. Remote Annunciator Panel: Surface mounted panel with brushed stainless steel. Furnish alarm horn, and indicators and alarms as follows:
   (1) High battery voltage (alarm).
   (2) Low battery voltage (alarm).
   (3) System ready.
   (4) Anticipatory-high water temperature.
   (5) Anticipatory-low oil pressure.
   (6) Low coolant temperature.
   (7) Switch in off position (alarm).

(8) Overcrank (alarm).
(9) Emergency stop (alarm).
(10) High water temperature (alarm).
(11) Overspeed (alarm).
(12) Low oil pressure (alarm).
(13) Line power available.
(14) Generator power available.
(15) Lamp test and horn silence switch.

viii. Weather-protective Enclosure: Reinforced steel housing allowing access to control panel and service points, with lockable doors and panels. Furnish fixed louvers, battery rack, and silencer.

g. SOURCE QUALITY CONTROL

i. Provide shop inspection and testing of completed assembly.

ii. Make completed engine-generator assembly available for inspection at manufacturer's factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.

iii. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Architect/Engineer at least seven days before inspections and tests are scheduled.

3. EXECUTION

a. INSTALLATION

i. Install engraved plastic nameplates in accordance with Section 16075.

ii. Ground and bond generator and other electrical system components in accordance with Section 16060.

b. FIELD QUALITY CONTROL

i. Section: Field inspecting, testing, adjusting, and balancing.

ii. Inspect and test in accordance with NETA ATS, except Section 4.

iii. Perform inspections and tests listed in NETA ATS, Section 7.22.

c. MANUFACTURER'S FIELD SERVICES

i. Quality Requirements: Manufacturer’s field services.

ii. Prepare and start up engine-generator assembly.

d. ADJUSTING

i. Execution Requirements: Testing, adjusting, and balancing.

ii. Adjust generator output voltage and engine speed to meet specified ratings.

e. CLEANING

i. Execution Requirements: Final cleaning.

ii. Clean engine and generator surfaces. Replace oil and fuel filters with new.

f. DEMONSTRATION AND TRAINING

i. Furnish 2 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

ii. Describe loads connected to standby system and restrictions for future load additions.

iii. Simulate power outage by interrupting normal source, and demonstrate system operates to provide standby power.

END OF SECTION

SECTION 16400

LOW-VOLTAGE DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes enclosed switches and circuit breakers; enclosed; panelboards; and fuses.

1.2 SUBMITTALS

A. Product Data: Submit catalog data showing products with specified features.

1.3 EXTRA MATERIALS

A. Furnish two of each panelboard key.

B. Furnish three spare fuses of each Class, size, and rating installed.

PART 2 PRODUCTS

2.1 ENCLOSED FUSIBLE SWITCH

A. Manufacturers:
1. Square D.
2. Substitutions: Permitted.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Enclosure: NEMA KS 1, Type to meet conditions.

2.2 ENCLOSED NONFUSIBLE SWITCH

A. Manufacturers:
1. Square D.
2. Substitutions: Permitted.

B. Product Description: NEMA KS 1, Type GD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Enclosure: NEMA KS 1, Type to meet conditions.

2.3 MOLDED CASE CIRCUIT BREAKER

A. Manufacturers:
   1. Square D.
   2. Substitutions: Permitted.

B. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1.

C. Enclosure: NEMA AB 1, Type to meet conditions.

2.4 MANUAL MOTOR CONTROLLER

A. Manufacturers:
   1. Square D.
   2. Substitutions: Permitted.

B. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, red pilot light, and push button operator.

C. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.5 FRACTIONAL-HORSEPOWER MANUAL MOTOR CONTROLLER

A. Manufacturers:
   1. Square D.
   2. Substitutions: Permitted.

B. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.

C. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.6 AUTOMATIC MOTOR CONTROLLERS

A. Manufacturers:
   1. Square D.
   2. Substitutions: Permitted.

B. Product Description: NEMA ICS 2, AC general-purpose Class A controller for induction motors rated in horsepower.

C. Control Voltage: 120 volts, 60 Hertz.

D. Product Options and Features:
   1. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty type.

2. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.

E. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using motor circuit protector conforming to NEMA AB 1, with integral instantaneous magnetic trip in each pole. Obtain IEC Class 2 coordinated component protection.

F. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.7 GENERAL PURPOSE CONTACTORS

A. Manufacturers:
1. Square D.
2. Substitutions: Permitted.

B. Product Description: NEMA ICS 2, AC general purpose magnetic contactor.

C. Coil operating voltage: 120 volts, 60 Hertz.

D. Poles: To match circuit configuration and control function.

E. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty type with Form Z contacts, rated A150.

F. Combination Contactors: Combine contractors with thermal magnetic circuit breaker conforming to NEMA AB 1, with integral thermal and instantaneous magnetic trip in each pole.

G. Enclosure: NEMA ICS 6, Type to meet conditions.

2.8 LIGHTING CONTACTORS

A. Manufacturers:
1. Douglas.
2. Asco.
3. Substitutions: Permitted.

B. Product Description: NEMA ICS 2, magnetic lighting contactor.

C. Configuration: Mechanically held, 2 wire control.

D. Coil operating voltage: 277 volts, 60 Hertz.

E. Poles: To match circuit configuration and control function.

F. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.

G. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty type with Form Z contacts, rated A150.

H. Combination Contractors: Combine contractors with thermal magnetic circuit breaker conforming to NEMA AB 1, with integral thermal and instantaneous magnetic trip in each pole.

I. Enclosure: NEMA ICS 6, Type to meet conditions.

2.9 DISTRIBUTION PANELBOARDS

A. Manufacturers:
1. Square D.
2. Substitutions: Permitted.

B. Product Description: NEMA PB 1, circuit breaker type panelboard.

C. Minimum integrated short circuit rating: 100,000 amperes rms symmetrical.

D. Panelboard bus: Copper.

E. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Furnish interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

F. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

G. Controllers: NEMA ICS 2, AC general-purpose Class A controller for induction motors rated in horsepower.
1. Control Voltage: 120 volts, 60 Hertz.
2. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty type.
3. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.

H. Enclosure: NEMA PB 1, Type to meet conditions.

I. Cabinet Front: Surface type, fastened with hinge and latch, hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

2.10 BRANCH CIRCUIT PANELBOARDS
1. Square D.
2. Substitutions: Permitted.

B. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

C. Minimum Integrated Short Circuit Rating: 22,000 amperes rms symmetrical.

D. Panelboard Bus: Copper.

E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

F. Enclosure: NEMA PB 1, Type to meet conditions.

G. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

2.11 FUSES

A. Manufacturers:
   1. Bussman.
   2. Substitutions: Permitted.

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

D. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).

E. Power Load Feeder Switches: Class RK1 (time delay). RK5. J (time delay).

F. Motor Load Feeder Switches: Class RK1 (time delay). RK5.

G. Motor Branch Circuits:Class RK1 (time delay). RK5. J (time delay).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install distribution equipment plumb.

B. Select and install overload heater elements in motor controllers to match installed motor characteristics.

C. Install panelboards in accordance with NEMA PB 1.1.

D. Install recessed panelboards flush with wall finishes.

E. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard.

END OF SECTION

SECTION 16500

LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories.

1.2 SUBMITTALS

A. Product Data: Submit dimensions, ratings, and performance data.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Product Description: Complete luminaire assemblies, with features, options, and accessories as indicated on Drawings.

B. Substitutions: Permitted.

2.2 EXIT SIGNS

A. Manufacturers:
   1. Cooper Industries.
   2. Leviton.
   3. Substitutions: Permitted.

B. Product Description: Exit sign fixture.

C. Stencil Face with green letters.

D. Input Voltage: 277 volts.

2.3 FLUORESCENT BALLASTS

A. Manufacturers:
   1. Cooper Industries Model.
   2. Duro-Test Corp. Model.
   3. General Electric Corp. Model.
   4. Hubbell Lighting Model.
   5. Magnetek Inc. Model.
   6. Pass & Seymour Model.
   7. Philips Electronic North America Model.

8. Thomas Industries, Inc. Model.
9. Substitutions: Permitted.

B. Product Description: Electronic ballast, suitable for lamps specified, with voltage to match luminaire voltage.

2.4 HIGH INTENSITY DISCHARGE (HID) BALLASTS

A. Manufacturers:
1. Duro-Test Corp. Model.
2. General Electric Corp. Model.
3. Philips Electronic North America Model.
4. Radiant Lamp Co. Model.
5. Siemens Corp. Model.
6. Venture Lighting International Inc. Model.
7. Substitutions: Permitted.

B. Product Description: ANSI C82.4, mercury vapor lamp ballast, suitable for lamp specified, with voltage to match luminaire voltage.

2.5 INCANDESCENT LAMPS

A. Manufacturers:
1. Duro-Test Corp. Model.
2. General Electric Corp. Model.
3. Hanson Industries Model.
4. Lithonia Lighting Model.
5. Neo-Ray Products Model.
6. Philips Electronic North America Model.
7. RCS Industries Co. Model.
8. Radiant Lamp Co. Model.
9. Substitutions: Permitted.

2.6 FLUORESCENT LAMPS

A. Manufacturers:
1. Duro-Test Corp. Model.
2. General Electric Corp. Model.
3. Hubbell Inc. Model.
4. Lithonia Lighting Model.
5. Philips Electronic North America Model.
6. Siemens Corp. Model.
7. Substitutions: Permitted.

2.7 HID LAMPS

A. Manufacturers:
   1. Duro-Test Corp. Model.
   2. General Electric Corp. Model.
   3. Philips Electronic North America Model.
   4. RCS Industries Co. Model.
   5. Siemens Corp. Model.
   6. Substitutions: Permitted.

2.8 METAL POLES

A. Manufacturers:
   1. Lithonia.
   2. Substitutions: Permitted.

B. Material and Finish: steel with painted finish.

C. Section Shape and Dimensions: Square.

D. Height: As indicated on Drawings.

E. Base: Nonbreakaway,

F. Accessories:
   1. Handhole.
   2. Anchor bolts.
   3. Duplex Outlet.

G. Loading Capacity Ratings:
   1. Luminaire Weight: pounds
   2. Luminaire and Bracket Effective Projected Area: square feet
   3. Steady Wind: 100 miles per hour, minimum.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers.

B. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

C. Install surface mounted ceiling luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

D. Install concrete bases in accordance with Section 03050 for lighting poles at locations as indicated on Drawings.

E. Install poles plumb.

3.2 ADJUSTING

A. Aim and adjust luminaires.

B. Relamp luminaires, lighting units, and exit signs with failed lamps at Substantial Completion.

END OF SECTION

SECTION 16700

COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes arrangement with Telephone Utility Company for service and premises telephone pathways, and premises wiring.

1.2 SYSTEM DESCRIPTION

A. Service entrance from Telephone Utility Company.

B. Telephone Utility Company: Qwest.

C. Service Entrance Pathway: Empty ducts and raceway from point of Telephone Utility connection at property line to building service terminal backboard.

D. Backbone Wiring: Conform to EIA/TIA 568A/569 and EIA/TIA TSB 72.

E. Horizontal Wiring: Conform to EIA/TIA 568A/569, using Cat. 6 cabling, cable tray, backboards, and cabinets.

F. Entrance Wiring: By Telephone Utility Company.

G. Backbone Wiring: Complete from entrance equipment to the IT Room using 6 strand multimode fiber and Cat 6 cable.

H. Horizontal Wiring: Complete from either telephone closet to each outlet using horizontal cables.

1.3 SUBMITTALS

A. Product Data: Submit catalog data for each termination device, cable, fiber, LIU and outlet device.

PART 2 PRODUCTS

2.1 TELEPHONE TERMINATION BACKBOARDS

A. Material: Plywood.

B. Size: 4 x 8 feet, 3/4 inch thick.

2.2 TELEPHONE OUTLET JACKS

A. Manufacturers:
   1. Ortronics
   2. Substitutions: Not Permitted.

B. Product Description: Conform to EIA/TIA 568A, 569 requirements for cable connectors for specific cable types.

2.3 BACKBONE FIBER AND CABLE

A. Manufacturers:
   1. Berk-Tek 12 strand multimode fiber optic.
   2. Berk-Tek LANmark Cat 6 4 pair 23 AWG, Unshielded Twisted Pair (UTP) cable
   3. Substitutions: Not Permitted.

B. Product Description:
   1. Fiber Optic: 12 strand 62.5/125 micron , multimode fiber, terminated with connectors in a L.I.U..
   2. Twisted pair copper Category 6, 23 AWG ,4 pair, plenum rated, with (12)cables installed between the IT Room and the Demark.

2.4 HORIZONTAL CABLE

A. Manufacturers:
   1. Berk-Tek
   2. Substitutions: Not Permitted.

B. Product Description: EIA/TIA 570, 100-ohm, unshielded twisted pair cable with 4 pairs, 23 AWG copper conductor. Install (2) cables per workstation (floor box).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install wire and cable in accordance with EIA/TIA 569, 570.

B. Finish paint termination backboards with durable white enamel prior to installation of telephone equipment.

C. Install termination backboards plumb, and attach securely to building wall at each corner. Install cabinet trim plumb.

D. Install pull wire or polyethylene pulling string in each empty telephone conduit over 10 feet in length or containing bend.

3.2 TESTING

A. Multimode fiber attenuation shall be measured in one direction at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference, two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) shall be based on the values set forth in TIA/EIA-568

B. All cables and termination hardware shall be 100% tested by the installation contractor for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feedthrough couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

C. All cables shall be tested in accordance with this document, and best industry practices. If any of these are in conflict, the Contractor shall be responsible to bring any discrepancies to the attention of the project team for clarification and/or resolution.

D. Each pair of each installed cable shall be tested using a continuity test set that shows opens, shorts, polarity and pair-reversals. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

E. Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number.

F. High speed unshielded twisted pair (UTP) data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:

Near End Cross-Talk (NEXT)
Attenuation
Ambient Noise
Attenuation to Cross-Talk Ratio (ACR)

G. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA-568-B Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from

the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

END OF SECTION