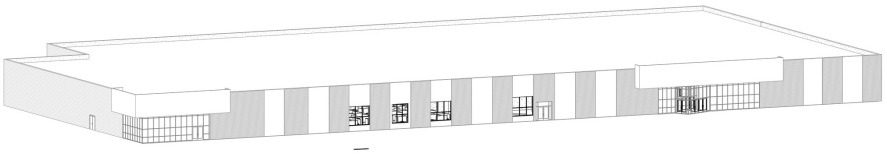
SECTION 00 01 01
PROJECT TITLE PAGE



PROJECT MANUAL
FOR
FSSA TERRE HAUTE OFFICES
ARCHITECT'S PROJECT NUMBER: 240101.
2801 WABASH AVENUE
TERRE HAUTE, INDIANA
DATE: 12-20-2024
CRIPE

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SECTION 00 01 02
PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

A. Project Name: FSSA Terre Haute Offices, located at: 2801 Wabash Avenue.

Project Location Address 1.

Terre Haute, IndianaProject Location ZIP.

B. The Owner, hereinafter referred to as Owner: State of Indiana

1.02 PROJECT DESCRIPTION

A. Summary Project Description: See Space Program.

B. Contract Scope: Construction, demolition, and renovation.

1.03 PROCUREMENT TIMETABLE

A. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.04 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:
   1. From Owner at the Project Manager's address listed above.
   2. At the following address: _____.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 00 01 03
PROJECT DIRECTORY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification of project team members and their contact information.

1.02 OWNER:

A. Name: Wabash Ave
   1. Address Line 1: 1221 Hulman St..
   2. City: Terre HAute.
   3. State: IN.
   4. Zip Code: 47802.
   5. Telephone: 812-208-1100.

B. Primary Contact: All correspondence from the Contractor to the Architect will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
   1. Title: Principle.
   2. Name: Silas Smith.
   3. Email: sylas.guaranteeroofing@gmail.com.

1.03 CONSULTANTS:

A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
   1. Company Name: Cripe.
      a. Address Line 1: 9339 Priority Way Dr., Set. 100.
      b. City: Indianapolis.
      c. State: IN.
      d. Zip Code: 46240.
      e. Telephone: 317.538.0392.
   2. Primary Contact:
      a. Title: Senior Project Manager.

B. Mechanical Engineering Consultant - MechanicalPlumbing:
   1. Company Name: Verdant Engineering.
      a. Address Line 1: 8949 Lafayette Road.
      b. City: Indianapolis.
      c. State: IN.
      d. Zip Code: 46278.
      e. Telephone: 317.446.1651.
   2. Primary Contact:
      a. Title: owner.
      b. Name: Mark Nordmeyer.
      c. Email: mnordmeyer@verdant-engr.com.

1.04 CONSTRUCTION MANAGER:

A. Company Name: Keymark Construction.
   1. Address Line 1: 1033 Lafayette Ave..
   2. City: Terre Haute.
   3. State: IN.
   4. Zip Code: 47804.
   5. Telephone: 812.232.3700.

B. Primary Contact:
   1. Title: President.

2. Name: Jacob Hellman.
3. Email: Jacob@mykeymark.com.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SEALS PAGE

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END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Control of installation.

G. Mock-ups.

H. Defect Assessment.

1.02 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2024.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

H. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.

1.03 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary stairs or steps required for construction access only.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
   1. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.05 QUALITY ASSURANCE

A. Contractor's Quality Control (CQC) Plan:

1.06 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

PART 3 EXECUTION

2.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. 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.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

2.02 MOCK-UPS

A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

2.03 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

2.04 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Owner, it is not practical to remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

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SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, _____.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

G. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

B. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

C. Section 01 76 10 - Temporary Protective Coverings: Materials for protection of installed work.

D. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

1.05 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.06 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over

adjacent property.

C. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

D. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations, and _____.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, and Electrical): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
   3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

F. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

G. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

H. Clean existing systems and equipment.

I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

J. Do not begin new construction in alterations areas before demolition is complete.

K. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:

1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. See Section 01 76 10 for temporary protective covering materials.

B. Protect installed work from damage by construction operations.

C. Provide special protection where specified in individual specification sections.

D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

G. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

H. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

I. Prohibit traffic from landscaped areas.

J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

3.10 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.11 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.12 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

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SECTION 01 76 10
TEMPORARY PROTECTIVE COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary protective coverings for installed floors, walls, and other surfaces.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Coordination of requirements for materials specified in this section.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

E. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes available; and installation instructions.

C. Shop Drawings: Indicate existing finished surfaces to be protected.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
   1. Water resistant.
   2. Vapor permeable.
   3. Impact resistant.
   4. Slip resistant.
   5. Flame retardant.

2.02 MATERIALS

A. Sheet Materials:
   1. Corrugated polypropylene sheet.
   2. Recycled paperboard/plastic composite sheet.
   3. Recycled paperboard sheet.
   4. Wood Hardboard: ANSI A135.4, tempered, 1/4 inch (6 mm) thick nominal.
   5. Plywood, 1/2 inch (13 mm) thick nominal.

B. Rolled Materials:
   1. Self-adhering polyethylene film.
   2. Recycled cellulose fiberboard paper.
   3. Laminated glass fiber reinforced kraft paper.
   4. Rosin coated paper.

C. Corner and Door Jamb Protection Materials:
   1. Cardboard, shaped specifically for application.
   2. PVC plastic.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove dirt and debris from surfaces to be protected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Trim or overlap sheet materials to fit area to be covered.

C. Roll out and cut rolled materials to fit area to be covered.

D. Stretch self-adhering film materials to completely cover surface.

3.03 REMOVAL

A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of building elements for alteration purposes.

C. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 31 22 00 - Grading: Rough and fine grading.

G. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 DEFINITIONS

A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.

B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

C. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

D. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

PART 3 EXECUTION

2.01 DEMOLITION

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

B. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.

3. Provide, erect, and maintain temporary barriers and security devices.
4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

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

C. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

D. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Dismantle existing construction and separate materials.
2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

2.03 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

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

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

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

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

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

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
1. Verify construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and required to accomplish new work.
1. Remove items indicated on drawings.

C. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

3. Verify that abandoned services serve only abandoned facilities before removal.
4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

D. Protect existing work to remain.
1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

2.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members and struts.

1.02 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2024).

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2013 (Reapproved 2018).

E. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2019.

F. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Shapes, Plates, and Bars: ASTM A242/A242M high-strength, corrosion-resistant structural steel.

E. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Miscellaneous framing and sheathing.

B. Communications and electrical room mounting boards.

C. Concealed wood blocking, nailers, and supports.

D. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

E. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2022.

F. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

G. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

J. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

L. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).

M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

N. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

O. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

P. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2024.

Q. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

R. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

S. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

T. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata.

U. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.

V. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

W. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2021).

Y. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-Bonded to Wood-Based Structural Sheathing, Used as Water-Resistive Barriers; 2008, with Editorial Revision (2021).

Z. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems; 2021, with Editorial Revision (2022).

AA. NELMA (SGR) - Standard Grading Rules for Northeastern Lumber; 2024.

BB. PS 1 - Structural Plywood; 2023.

CC. PS 2 - Performance Standard for Wood Structural Panels; 2018.

DD. PS 20 - American Softwood Lumber Standard; 2021.

EE. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2019.

FF. SPIB (GR) - Standard Grading Rules; 2021.

GG. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2018.

HH. WWPA G-5 - Western Lumber Grading Rules; 2021.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Samples: For rough carpentry members that will be exposed to view, submit two samples, ____by____ inch (____by____ mm) in size illustrating wood grain, color, and general appearance.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

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

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Northeastern Lumber Manufacturers Association; NELMA (SGR).

B. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

C. Grading Agency: Redwood Inspection Service; RIS (GR).

D. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).

E. Grading Agency: Western Wood Products Association; WWPA G-5.

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

G. Moisture Content: S-dry or MC19.

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

2.03 EXPOSED DIMENSION LUMBER

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

C. Grading Agency: Redwood Inspection Service; RIS (GR).

D. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).

E. Grading Agency: Western Wood Products Association; WWPA G-5.

F. Sizes: Nominal sizes as indicated on drawings.

G. Surfacing: S4S.

H. Moisture Content: S-dry or MC19.

2.04 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (15 percent maximum).

C. Surfacing: S4S.

D. Species: Douglas Fir.

E. Grade: No. 2, 2 Common, or Construction.

2.05 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: PS 1 or PS 2 type, rated Single Floor.
   1. Panel Type: Plywood or Oriented Strand Board.
   2. Bond Classification: Exposure 1.
   3. Span Rating: 48.
   4. Performance Category: 1-1/8 PERF CAT.
   5. Edges: Tongue and groove.

B. Wall Sheathing: Glass mat faced gypsum with integral water-resistive and air barrier, ASTM C1177/C1177M, 5/8 inch (15.9 mm) thick.
   1. Water Vapor Permeance: 1 perm (57.5 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M.

2.06 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Gypsum Board Screws: ASTM C1002; Type W, bugle head, self-piercing, tapping screws; length to penetrate wood members 5/8 inch (15.9 mm) minimum.

PART 3 EXECUTION

3.01 PREPARATION

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

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

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and _____.

E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

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

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

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

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.05 INSTALLATION OF CONSTRUCTION PANELS

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.07 CLEANING

A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.

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

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

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

END OF SECTION

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SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Factory finishing.

E. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 08 80 00 - Glazing: Glass for casework.

C. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

B. ANSI A208.1 - American National Standard for Particleboard; 2022.

C. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

D. AWI (QCP) - Quality Certification Program; Current Edition.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

G. BHMA A156.9 - Cabinet Hardware; 2020.

H. GSA CID A-A-1936 - Adhesives, Contact, Neoprene Rubber; 1996a (Validated 2013).

I. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

J. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
3. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
6. Replace, repair, or rework all work for which certification is refused.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Breakroom Cabinets: Plastic laminate faced, Custom grade.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 PANEL CORE MATERIALS

A. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.
1. Grade: 115; moisture resistance: MR10.
2. Panel Thickness: 1 inch (25.4 mm).

2.04 HARDWOOD PLYWOOD PANELS

A. Hardwood Plywood: Plywood manufactured for nonstructural decorative applications; consisting of faces and backs applied to a variety of core types; comply with HPVA HP-1.
1. Woodwork Quality Standard: Panels complying with specified woodwork quality standard.

2.05 LAMINATE MATERIALS

A. Provide specific types as indicated.

2.06 COUNTERTOPS

A. Countertops: See Section 12 36 00.

2.07 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Vinyl Countertop Edge: PVC anchor type tee-molding edging in width to match thickness of countertop, color as indicated, used at locations as indicated.

C. Glass: Type A, see Section 08 80 00.

D. Fasteners: Size and type to suit application.

E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.08 HARDWARE

A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades indicated below:
   1. Hardware Types: As indicated on drawings.
   2. Product Grade: Grade 2.

B. Metal Z-Shaped Wall Cabinet Support Clips: Paired, cleated, structural anchorage components applied to back of cabinets and walls for wall cabinet mounting.
   1. Material: Extruded Aluminum.

C. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

D. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.
   1. Materials: Steel; T-shape cross-section.
      a. Finish: Manufacturer's standard, factory-applied, powder coat.
   2. Materials: Steel plates.
      a. Finish: Manufacturer's standard, factory-applied, black powder coat.
   3. Materials: Aluminum sections.
      a. Finish: Clear anodized.

E. Vanity Brackets: Fixed, ADA-compliant, face-of-stud mounting.
   1. Material and Shape: Steel; formed compound shapes.
      a. Finish: Manufacturer's standard, factory-applied, textured powder coat.

F. Countertop Brackets; L-shaped, top of knee wall mounting.
   1. Materials: Steel plates.
   2. Finish: Manufacturer's standard, factory-applied, powder coat.

G. Vanity Brackets: Cantilevered support leg, face-of-stud mounting.
   1. Materials: Steel T-shapes.
   2. Finish: Manufacturer's standard, factory-applied, powder coat.

H. Vanity Brackets: Cantilevered support legs with wall header, face-of-wall mounting.
   1. Materials: Steel angles.
   2. Finish: Manufacturer's standard, factory-applied, powder coat.

I. Countertop Brackets: Fixed, concealed vertical leg, side-of-stud mounting.
   1. Materials: Steel L- and T-shapes.

J. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).

K. Sliding Door Pulls: Circular shape for recessed installation, steel with satin finish.

L. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

M. Cabinet Catches and Latches:
   1. Type: Push latch.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches (400 mm) on center.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

C. Section 09 91 13 - Exterior Painting: Field painting.

D. Section 09 91 23 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SCIF: Sensitive Compartmented Information Facility.

G. SDI: Steel Door Institute.

H. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2019.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

J. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

K. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

O. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

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

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, 2 by 2 inches (51 by 51 mm) in size, showing factory finishes, colors, and surface texture.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: https://steeldoor.org/sdi-certified/#sle.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

D. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   3. Deansteel Manufacturing Company, Inc; Hollow Metal Doors - SP Series: www.deansteel.com/#sle.
   4. Steelcraft, an Allegion brand; ____: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Manufacturers standard for application indicated.

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

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Full profile/continuously welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
   3. Frame Finish: Factory primed and field finished.
   4. Weatherstripping: Separate, see Section 08 71 00.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
   2. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
   3. Frame Finish: Factory primed and field finished.

E. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.
   2. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
   3. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.

2.05 FINISHES

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

2.06 ACCESSORIES

A. Door Window Frames: Door window frames with glazing securely fastened within door opening.

B. Glazing: As specified in Section 08 80 00, factory installed.

C. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
   1. UL listed products in compliance with requirements of authorities having jurisdiction.
   2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
   3. Astragal Type: Split, two parts, and with automatic locking, cutouts for other door hardware, and sealing gasket.
   4. Edge Type: Beveled edge
   5. Material: Aluminum.
   6. Metal Finish: Beige powder coating.
   7. Provide non-corroding fasteners at exterior locations.

D. Astragals for Double Doors: Specified in Section 08 71 00.

E. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

F. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

G. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

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

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

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

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

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

D. Install door hardware as specified in Section 08 71 00.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

3.06 SCHEDULE

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

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.

B. Section 08 11 13 - Hollow Metal Doors and Frames.

C. Section 08 71 00 - Door Hardware.

D. Section 08 80 00 - Glazing.

E. Section 09 91 23 - Interior Painting: Field finishing of doors.

F. Section 09 93 00 - Staining and Transparent Finishing: Field finishing of doors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

C. ANSI A208.1 - American National Standard for Particleboard; 2022.

D. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

H. AWI (QCP) - Quality Certification Program; Current Edition.

I. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

J. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

K. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of door construction, ___ by ___ inches (___ by ___ mm) in size cut from top corner of door.

E. Samples: Submit two samples of door veneer, 12 by 12 inches (___ by ___ mm) in size illustrating wood grain, stain color, and sheen.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Manufacturer's Installation Instructions: Indicate special installation instructions.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

J. Specimen warranty.

K. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
   1. Company with at least one project within past five years with value of woodwork within at least 20 percent of cost of woodwork for this project.
   2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

D. Woodwork Quality Assurance Program:
   1. Comply with AWI (QCP) woodwork association quality assurance service/program in accordance with requirements for work specified in this section; www.awiqcp.org/#sle.
   2. Provide labels indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   3. Provide designated labels on shop drawings as required by quality assurance program.
   4. Provide designated labels on installed products as required by quality assurance program.
   5. Submit documentation upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
   1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Haley Brothers; ____: www.haleybros.com/#sle.
   2. Horton Automatics, a division of Overhead Door Corporation; FlexBarn: www.overheaddoor.com/#sle.
   3. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.
   4. VT Industries, Inc; ____: www.vtindustries.com/#sle.

2.02 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Wood veneer facing for field transparent finish as indicated on drawings.
   3. Wood veneer facing for field opaque finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

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

2.04 DOOR FACINGS

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

B. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
   1. Exception: Doors to be field finished.

F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Stain: As selected by Architect.
      c. Sheen: Flat.

B. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
   1. Transparent:
      a. System - TR-2, Catalyzed Lacquer.
      b. Stain: As selected by Architect.
      c. Sheen: Flat.

C. Factory finish doors in accordance with approved sample.

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

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 08 11 13.

B. Glazed Openings:
   1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
   2. Glazing: Single vision units, 1/4 inch (6.4 mm) thick glass.

3. Tint: Clear.

C. Glazing: See Section 08 80 00.

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

E. Astragals and Edges for Double Doors: Pairs of doors astragals, and door edge sealing and protection devices.
   1. UL listed products in compliance with requirements of authorities having jurisdiction.
   2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
   3. Astragal Type: Split, two parts, and with automatic locking, cutouts for other door hardware, and sealing gasket.
   4. Edge Type: Beveled edge
   5. Material: Aluminum.
   6. Metal Finish: Beige powder coating.
   7. Provide non-corroding fasteners at exterior locations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

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

3.02 INSTALLATION

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

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

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

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

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE

A. See Door and Frame Schedule appended to this section.

END OF SECTION

SECTION 08 41 26
ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All-glass entrances.

B. Swinging doors.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Supplementary supports.

B. Section 08 71 00 - Door Hardware.

C. Section 09 21 16 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1036 - Standard Specification for Flat Glass; 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

F. BHMA A156.3 - Exit Devices; 2020.

G. BHMA A156.4 - Door Closers and Pivots; 2024.

H. BHMA A156.13 - Mortise Locks & Latches Series 1000; 2022.

I. BHMA A156.17 - Self Closing Hinges & Pivots; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each component in all-glass entrance assembly.

C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
   1. Include field measurements of openings.
   2. Include elevations showing:
      a. Appearance of all-glass entrance layouts.
      b. Locations and identification of manufacturer-supplied door hardware and fittings.
      c. Locations and sizes of cut-outs and drilled holes for other door hardware.
   3. Include details of:
      a. Requirements for support and bracing at openings.
      b. Installation details.
      c. Appearance of manufacturer-supplied door hardware and fittings.
   4. Schedule: Listing of each type component in all-glass entrance assemblies, cross-referenced to shop drawing plans, elevations, and details.

D. Selection Samples: Two sets, representing manufacturer's full range of available metal materials and finishes.

E. Verification Samples: Two samples, minimum size 2 by 3 inches (50 by 75 mm), representing actual material and finish of exposed metal.

F. Certificates: Contractor's certification that installer of entrance assemblies meets specified qualifications.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Minimum three years of experience installing entrance assemblies similar to those specified in this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. All-Glass Entrances and Storefronts:
   1. Avanti Systems USA; Eclipse Standard Doors: www.avantisystemsusa.com/#sle.
   2. GGI - General Glass International; _____: www.generalglass.com/#sle.
   3. Optima Products Ltd; Axile Series Sliding Glass Doors: optimasystems.com/#sle.
   4. Trulite Glass & Aluminum Solutions, LLC; _____: www.trulite.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fittings and Hardware:
   1. Avanti Systems USA; Double Glazed Acoustic Swing Door Hardware: www.avantisystemsusa.com/#sle.
   2. DORMA USA, Inc; ____: www.dorma.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALL-GLASS ENTRANCES AND STOREFRONTS

A. Manufacturers:
   1. Avanti Systems USA, Inc; _____: www.avantisystemsusa.com/#sle.
   2. DORMA USA, Inc; _____: www.dorma.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FITTINGS AND HARDWARE

A. Rail Style Fittings for Swinging Doors and Related Fixed Glazing:
   1. Top Rails: 4-7/8 inch (124 mm) high with matching end caps.
   2. Bottom Rails: 10 inch (254 mm) high with matching end caps.
   3. Sidelite Rails: Match door rail sightlines.
   4. Exposed Edge Profile: Square.

B. Patch Style Fittings for Swinging Doors and Related Fixed Glazing:
   1. Top Fittings: 4-1/2 by 4-1/2 inch, square (114 by 114 mm, square), nominal.
   2. Bottom Fittings: 3-9/16 inch high (90 mm high), nominal.
   3. Fitting Length: 8 inches (203 mm).
   4. Exposed Edge Profile: Square.

C. Headers for Swinging Doors and Related Fixed Glazing:
   1. Dimensions: 1-3/4 inch deep by 4-1/8 inch high (44.4 mm deep by 104.7 mm high).
   2. Glass Thickness: 3/8 inch (9.5 mm).
   3. Aluminum Finish: As indicated.

D. Pivot Systems for Glass Swinging Doors:
   1. Pivots: Comply with BHMA A156.17.

2.04 BASIS OF DESIGN - FITTINGS AND HARDWARE

A. Rail Style Fittings for Swinging Doors and Related Fixed Glazing:
   1. Basis of Design: DORMA USA, Inc; DRS Rail System: www.dorma.com/#sle.

a. Full Length Top Rails: 3-5/16 inch (84 mm) high, tapered edge.
b. Full Length Bottom Rails: 2-5/16 inch (59 mm) high.
c. Sidelite Rails: Match door rail sightlines.
d. Aluminum Finish: Satin anodized.

B. Patch Style Fittings for Swinging Doors and Related Fixed Glazing:
1. Basis of Design: DORMA USA, Inc; Universal Patch Fittings: www.dorma.com/#sle.
a. Height: 3-5/16 inch (84 mm), tapered edge.
b. Length: 10-1/2 inch (267 mm).
c. Sidelite Rails: Match door rail sightlines.
d. Aluminum Finish: Satin anodized.
e. Integral Lock: Top rail only.

2.05 MATERIALS

A. Glass: Flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, Quality Q3, and Kind FT, fully tempered, in accordance with ASTM C1048, and as follows:
1. Thickness: 3/8 inch (9.5 mm).
2. Color: Class 1, Clear.
3. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.

B. Sealant: One-part silicone sealant, comply with ASTM C920, clear.

2.06 ACCESSORIES

A. Exposed Fittings and Hardware: Extruded aluminum, clear anodized finish.

B. Fixed Glazed Panel Fittings: Sufficient to structurally support glazing and doors under specified loads; including but not limited to cover caps for door hardware, glazing mullions, clamp fittings, panel corner patches, and _____.

C. Sidelight and Transom Fittings: No rails; provide extruded aluminum channels, for recessed installation in construction above and below glazing panels for frameless appearance.

D. Sidelight and Transom Fittings:
1. Rails: Match profile, material, and finish of rails specified for doors.
2. Provide top and bottom installation track for sidelite installation.

E. Swinging Door Fittings with Pivots: Patch fitting at top pivot corner of door; continuous rail with pivot at bottom of door.
1. Rail Cross-Section: 1-3/4 inches (44.4 mm) wide by 3-1/2 inches (88.9 mm) high.
2. Rail Profile: Tapered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are acceptable.

B. Do not begin installation until substrates and openings have been properly prepared.

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

3.02 PREPARATION

A. Clean substrates thoroughly prior to installation.

B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Installation of cold-formed metal framing for openings as specified in Section 05 40 00.

B. Installation of metal framing for openings as specified in Section 09 21 16.

C. Install in accordance with manufacturer's installation instructions.

D. Tolerances:
   1. Horizontal Components and Sight Lines: Not more than 1/8 inch in 10 feet (3.2 mm in 3 m) variation from level, non-cumulative.
   2. Vertical Components and Sight Lines: Not more than 1/8 inch in 10 feet (3.2 mm in 3 m) variation from plumb, non-cumulative.
   3. Variation from Plane or Indicated Location: Not more than 1/16 inch (1.6 mm).

E. Installation of door hardware not supplied by entrance/storefront manufacturer as specified in Section 08 71 00.

3.04 ADJUSTING

A. Adjust doors to operate correctly, without binding to frame, sill, or adjacent doors.

B. Adjust door hardware for smooth operation.

3.05 CLEANING

A. Clean installed work to like-new condition.

3.06 PROTECTION

A. Protect installed products until Date of Substantial Completion.

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

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, hollow metal, and ____ doors.
B. Hardware for fire-rated doors.
C. Electrically operated and controlled hardware.
D. Lock cylinders for doors that hardware is specified in other sections.
E. Thresholds.
F. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.
B. Section 06 41 00 - Architectural Wood Casework: Cabinet hardware.
C. Section 07 92 00 - Joint Sealants: Sealants for setting exterior door thresholds.
D. Section 08 06 71 - Door Hardware Schedule: Schedule of door hardware sets.
E. Section 08 11 13 - Hollow Metal Doors and Frames.
F. Section 08 11 16 - Aluminum Doors and Frames.
G. Section 08 12 13 - Hollow Metal Frames.
H. Section 08 14 16 - Flush Wood Doors.
I. Section 08 71 13 - Power Door Operators.
J. Section 28 10 00 - Access Control: Electronic access control devices.

1.03 PRICE AND PAYMENT PROCEDURES

A. Allowances: See Section 01 21 00 - Allowances, for cash allowances affecting this section.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. BHMA (CPD) - Certified Products Directory; Current Edition.
C. BHMA A156.1 - Standard for Butts and Hinges; 2021.
D. BHMA A156.2 - Bored and Preassembled Locks and Latches; 2022.
E. BHMA A156.3 - Exit Devices; 2020.
F. BHMA A156.4 - Door Closers and Pivots; 2024.
G. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.
H. BHMA A156.6 - Standard for Architectural Door Trim; 2021.
I. BHMA A156.7 - Template Hinge Dimensions; 2022.
J. BHMA A156.8 - Door Controls - Overhead Stops and Holders; 2021.
K. BHMA A156.13 - Mortise Locks & Latches Series 1000; 2022.
L. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.
M. BHMA A156.18 - Standard for Materials and Finishes; 2020.
N. BHMA A156.20 - Standard for Strap and Tee Hinges, and Hasps; 2021.
O. BHMA A156.21 - Thresholds; 2019.
P. BHMA A156.22 - Standard for Gasketing; 2021.
Q. BHMA A156.25 - Electrified Locking Devices; 2023.

R. BHMA A156.26 - Standard for Continuous Hinges; 2021.

S. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2023.

T. BHMA A156.30 - High Security Cylinders; 2020.

U. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2024.

V. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

W. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

X. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.

Y. DHI (KSN) - Keying Systems and Nomenclature; 2019.

Z. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

AA. ITS (DIR) - Directory of Listed Products; Current Edition.

BB. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

CC. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

DD. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

EE. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.

FF. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

GG. UL (DIR) - Online Certifications Directory; Current Edition.

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

II. UL 437 - Standard for Key Locks; Current Edition, Including All Revisions.

JJ. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

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

C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

D. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Installer's Architectural Hardware Consultant (AHC).
      d. Hardware Installer.
      e. Owner's Security Consultant.
   3. Agenda:
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Access control requirements.
      b. Key control system requirements.
      c. Schematic diagram of preliminary key system.
      d. Flow of traffic and extent of security required.

5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
3. List groups and suffixes in proper sequence.
4. Provide complete description for each door listed.
5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. Samples for Verification:
1. Submit minimum size of 2 by 4 inch (51 by 102 mm) for sheet samples, and minimum length of 4 inch (102 mm) for other products.
2. Submit one (1) sample of hinge, latchset, lockset, closer, and _____ illustrating style, color, and finish.
3. Return full-size samples to Contractor.
4. Submit product description with samples.

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

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
1. Submit manufacturer's parts lists and templates.
2. Bitting List: List of combinations as furnished.

H. Keying Schedule:
1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

I. Manufacturer's qualification statement.

J. Installer's qualification statement.

K. Supplier's qualification statement.

L. Specimen warranty.

M. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

N. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Lock Cylinders: Ten for each master keyed group.
   3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.07 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Five years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Applicable provisions of NFPA 101.
   4. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   5. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, or _____ as suitable for application indicated.
   6. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
      a. Air Leakage Rate: Tested in accordance with UL 1784, with air leakage rate not to exceed 3.0 cfm/sf (0.01524 cu m/sec/sq m) of door opening at 0.10 inch (24.9 Pa) of water for both ambient and elevated temperature tests.
   7. Listed and certified compliant with specified standards by BHMA (CPD).

8. Auxiliary Hardware: BHMA A156.16.
9. Straps and Tee Hinges: BHMA A156.20.
10. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
11. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
12. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
1. See Section 28 10 00 for additional access control system requirements.

2.02 HINGES

A. Manufacturers:
1. McKinney; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
2. D&D Technologies USA, Inc; SureClose ConcealFit: www.ddtech.com/#sle.
3. Hager Companies; _____: www.hagerco.com/#sle.
4. BEST, dormakaba Group; _____: www.bestaccess.com/#sle.

B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
a. Provide hinge width required to clear surrounding trim.
2. Continuous Hinges: Comply with BHMA A156.26.
3. Provide hinges on every swinging door.
4. Provide following quantity of butt hinges for each door:
a. Doors up to 60 inches (1.5 m) High: Two hinges.

2.03 PIVOTS

A. Manufacturers:
1. McKinney or Rixson; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
2. Ives, an Allegion brand; _____: www.allegion.com/us/#sle.
3. BEST, dormakaba Group; _____: www.bestaccess.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Door Weight: Medium; standard openings with up to 650 lbs door weight.

2.04 FLUSH BOLTS

A. Manufacturers:
1. Hager Companies; _____: www.hagerco.com/#sle.
2. Trimco; _____: www.trimcohardware.com/#sle.

B. Flush Bolts: Comply with BHMA A156.16, Grade 1.
1. Flush Bolt Throw: 3/4 inch (19 mm), minimum.
2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
4. Manual Flush Bolts: Provide lever extensions for top bolt at over-sized doors.

2.05 EXIT DEVICES

A. Manufacturers:
1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
2. Hager Companies; _____: www.hagerco.com/#sle.

3. BEST, dormakaba Group; BEST Precision 100/200/300 Series: www.bestaccess.com/#sle.

B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.06 ELECTRIC STRIKES

A. Manufacturers:
1. Adams Rite, HES, or Securitron; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
2. dormakaba; RCI 0 Series: www.dormakaba.com/#sle.
3. Pamex, Inc; Electric Strikes: www.pamexinc.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.

2.07 LOCK CYLINDERS

A. Manufacturers:
1. BEST, dormakaba Group; _____: www.bestaccess.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
1. Provide standard, electronic, conventional, full size interchangeable core (FSIC), and small format interchangeable core (SFIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
2. Provide high security mechanical type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.30 or UL 437 at locations indicated.
3. Provide cylinders from same manufacturer as locking device.
4. Provide cams and/or tailpieces as required for locking devices.

2.08 CYLINDRICAL LOCKS

A. Manufacturers:
1. BEST, dormakaba Group; 8K Series: www.bestaccess.com/#sle.

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
1. Bored Hole: 2-1/8 inch (54 mm) diameter.
2. Latchbolt Throw: 1/2 inch (12.7 mm), minimum.
3. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
a. Finish: To match lock or latch.

2.09 MORTISE LOCKS

A. Manufacturers:
1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
2. BEST, dormakaba Group; 45H Series: www.bestaccess.com/#sle.
3. Hager Companies; _____: www.hagerco.com/#sle.
4. Schlage, an Allegion brand; _____: www.allegion.com/us/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
   1. Latchbolt Throw: 3/4 inch (19 mm), minimum.
   2. Deadbolt Throw: 1 inch (25.4 mm), minimum.
   3. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.
   4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
      a. Finish: To match lock or latch.

2.10 ELECTROMECHANICAL LOCKS

A. Manufacturers:
   1. Alarm Lock, a subsidiary of NAPCO Security Technologies, Inc; Electronic Cylindrical Locks: www.alarmlock.com/#sle.
   2. Sargent or Yale; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   3. BEST, dormakaba Group; 45HW Series: www.bestaccess.com/#sle.
   4. Hager Companies; _____: www.hagerco.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Electromechanical Locks: Comply with BHMA A156.25, Grade 1, Security, 1000 Series
   1. Provide motor-driven or solenoid-driven locks, with strike that is applicable to frame.
   2. Type: Mortise deadbolt.

2.11 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Hager Companies; _____: www.hagerco.com/#sle.

B. Door Pulls and Push Plates: Comply with BHMA A156.6.
   1. Pull Type: Straight, unless otherwise indicated.
   2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
      a. Edges: Beveled, unless otherwise indicated.
   3. Material: Aluminum, unless otherwise indicated.

2.12 COORDINATORS

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Hiawatha, Inc, division of Activar Construction Products Group, Inc; _____: www.activarcpg.com/hiawatha/#sle.
   3. Pamex, Inc; Coordinators: www.pamexinc.com/#sle.
   4. Trimco; _____: www.trimcohardware.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
   1. Type: Bar, unless otherwise indicated.
   2. Material: Aluminum, unless otherwise indicated.
   3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.13 CLOSERS

A. Manufacturers; Surface Mounted:
   1. BEST, dormakaba Group; EHD9000: www.bestaccess.com/#sle.
   2. Hager Companies; _____: www.hagerco.com/#sle.
   3. Pamex, Inc; Closers: www.pamexinc.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Closers: Comply with BHMA A156.4, Grade 1.
   1. Type: Surface mounted to door.

2. Provide door closer on each exterior door.
3. Provide door closer on each fire-rated and smoke-rated door.
    a. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
5. At corridor entry doors, mount closer on room side of door.
6. At outswinging exterior doors, mount closer on interior side of door.

2.14 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
    1. Rixson or Sargent; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
    2. dormakaba; 900 Series: www.dormakaba.com/#sle.
    3. Glynn-Johnson, an Allegion brand; _____: www.allegion.com/us/#sle.
    4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
    1. Provide stop for every swinging door, unless otherwise indicated.

2.15 POWER DOOR OPERATORS

A. See Section 08 71 13.

2.16 PROTECTION PLATES

A. Manufacturers:
    1. Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.

B. Protection Plates: Comply with BHMA A156.6.

C. Metal Properties: Aluminum material.
    1. Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.
    2. Metal, Heavy Duty: Thickness 0.062 inch (1.57 mm), minimum.
    3. Metal, Extra Heavy Duty - Diamond Plate: Thickness 1/8 inch (3.175 mm), minimum, with raised diamond plate surface.
    4. Metal, Extra Heavy Duty - Flat Plate: Thickness 1/8 inch (3.175 mm), minimum, with smooth plate surface.

D. Edges: Beveled, on four sides unless otherwise indicated.

E. Fasteners: Countersunk screw fasteners.

2.17 ARMOR PLATES

A. Manufacturers:
    1. Hiawatha, Inc, an Activar Construction Products Group company; _____: www.activarcpg.com/hiawatha/#sle.
    2. Trimco; _____: www.trimcohardware.com/#sle.

B. Armor Plates: Provide on bottom half of push side of doors that require protection from objects moving through openings that may damage door surface.
    1. Size: 16 inch (406 mm) high by 1-1/2 inch (38 mm) less door width (LDW) on pull side and 2 inch (51 mm) LDW on push side of door.

2.18 KICK PLATES

A. Manufacturers:
    1. Hiawatha, Inc, an Activar Construction Products Group company; _____: www.activarcpg.com/hiawatha/#sle.
    2. Standard Metal Hardware Manufacturing Ltd; Door Plates: www.smhardware.com/#sle.

B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
    1. Size: 8 inch (203 mm) high by 2 inch (51 mm) less door width (LDW) on push side of door.

2.19 FLOOR STOPS

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Hager Companies; _____: www.hagerco.com/#sle.
   3. Standard Metal Hardware Manufacturing Ltd; Floor Stops: www.smhardware.com/#sle.
   4. Sugatsune America, Inc; Door Stoppers: www.sugatsune.com/#sle.
   5. Trimco; _____: www.trimcohardware.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
   1. Type: Manual hold-open, with pencil floor stop.
   2. Material: Aluminum housing with rubber insert.

2.20 WALL STOPS

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Hager Companies; _____: www.hagerco.com/#sle.
   3. Hiawatha, Inc, division of Activar Construction Products Group, Inc; _____: www.activarcpg.com/hiawatha/#sle.
   4. Standard Metal Hardware Manufacturing Ltd; Wall Stops: www.smhardware.com/#sle.
   5. Trimco; _____: www.trimcohardware.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
   1. Type: Bumper, concave, wall stop.
   2. Material: Aluminum housing with rubber insert.

2.21 ASTRAGALS

A. Manufacturers:
   1. Pemko; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Hager Companies; _____: www.hagerco.com/#sle.
   3. National Guard Products, Inc; _____: www.ngpinc.com/#sle.
   4. Reese Enterprises, Inc; _____: www.reeseusa.com/#sle.
   5. Standard Metal Hardware Manufacturing Ltd; Astragals: www.smhardware.com/#sle.
   6. Zero International, Inc; _____: www.zerointernational.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Astragals: Comply with BHMA A156.22.
   1. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
   2. Type: Split, two parts, and with sealing gasket.
   3. Material: Aluminum, with neoprene weatherstripping.
   4. Provide non-corroding fasteners at exterior locations.

2.22 THRESHOLDS

A. Manufacturers:
   1. Dunbarton Corporation; _____: www.dunbarton.com/#sle.
   2. Pemko; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   3. Hager Companies; _____: www.hagerco.com/#sle.
   4. National Guard Products, Inc; _____: www.ngpinc.com/#sle.
   5. Reese Enterprises, Inc; _____: www.reeseusa.com/#sle.
   6. Zero International, Inc; _____: www.zerointernational.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Thresholds: Comply with BHMA A156.21.
   1. Provide threshold at each exterior door, unless otherwise indicated.
   2. Type: Flat surface.
   3. Material: Aluminum.
   4. Threshold Surface: Fluted horizontal grooves across full width.
   5. Field cut threshold to profile of frame and width of door sill for tight fit.
   6. Provide non-corroding fasteners at exterior locations.

2.23 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. Dunbarton Corporation; _____: www.dunbarton.com/#sle.
   2. Pemko; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   3. Hager Companies; _____: www.hagerco.com/#sle.
   4. National Guard Products, Inc; _____: www.ngpinc.com/#sle.
   5. Reese Enterprises, Inc; _____: www.reeseusa.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
   1. Head and Jamb Type: Adjustable.
   2. Door Sweep Type: Encased in retainer.
   3. Material: Aluminum, with brush weatherstripping.

2.24 BUMPER GUARD

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Bumper Guard: Provide to protect door surface and operating hardware from being damaged by heavy objects that move through opening.
   1. Type: Exit device, surface mounted.
   2. Material: Stainless steel.

2.25 SILENCERS

A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
   1. Single Door: Provide three on strike jamb of frame.
   2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
   3. Material: Rubber, gray color.

2.26 VERTICAL ROD COVERS

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Vertical Rod Covers: Provides protection from damage or tampering of surface mounted bottom vertical rod of exit device and to accommodate ADA Standards.
   1. Length: 12 inch (305 mm).
   2. Material: Stainless steel.

2.27 VIEWER

A. Manufacturers:
   1. Substitutions: See Section 01 60 00 - Product Requirements.

B. Viewer: Provide at inside of door at eye level to see who is on outside of door, with integral door knocker.
   1. Material: Brass.

2.28 KEY CONTROL SYSTEMS

A. Manufacturers:
   1. BEST, dormakaba Group; _____: www.bestaccess.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Key Control Systems: Comply with guidelines of BHMA A156.28.
   1. Provide keying information in compliance with DHI (KSN) standards.
   2. Keying: Grand master keyed.
   3. Include construction keying and control keying with removable core cylinders.
   4. Key to existing keying system.
   5. Supply keys in following quantities:
      a. 4 each Master keys.
      b. 1 each Grand Master keys.
      c. 6 each Construction Master keys.
      d. 15 each Construction keys.
      e. 2 each Construction Control keys.
      f. 2 each Control keys if new system.
   6. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
   7. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
   8. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
   9. Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.
   10. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
   11. Owner or Owner's agent install permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.29 KEY CABINET

A. Manufacturers:
   1. Knox Company; _____: www.knoxbox.com/#sle.

B. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
   1. Mounting: Wall-mounted.
   2. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
   3. Horizontal metal hook strips with replaceable labels covered with clear plastic.
   4. Size key hooks to hold 6 keys each.
   5. Finish: Baked enamel, manufacturer's standard color.
   6. Key cabinet lock to building keying system.

2.30 FIRE DEPARTMENT LOCK BOX

A. Manufacturers:
   1. Knox Company; Knox-Box Rapid Entry System, _____: www.knoxbox.com/#sle.

B. Fire Department Lock Box:
   1. Heavy-duty, surface mounted, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.
   2. Capacity: Holds 10 keys.
   3. Finish: Manufacturer's standard dark bronze.

2.31 KEY PAD

A. Manufacturers:
   1. Alarm Lock, a subsidiary of NAPCO Security Technologies, Inc: www.alarmlock.com/#sle.

2. Securitron; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Key Pad: Indoor or outdoor use, 12-key digital keypad with silicone rubber keys, and compatible with access control systems using standard Wiegand output.
1. Power: 12 VDC; 35mA Active and 7mA at Rest.
2. Mounts on narrow mullion, 1-1/2 inch wide by 7 inch high by 1 inch deep (38 mm wide by 178 mm high by 25.4 mm deep).
3. Operating Temperature: Minus 22 to 158 degrees F (Minus 30 to 70 degrees C).
4. Finish: Black.

2.32 POWER SUPPLY

A. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
1. Power: 12 VAC, 20 Amp; with 120 VAC power supply.
2. Operating Temperature: 32 to 110 degrees F (0 to 43 degrees C).
3. Provide with emergency release terminals that release devices upon activation of fire alarm system.

2.33 FINISHES

A. Finishes: Identified in Section 08 0671 - Door Hardware Schedule.

B. Finishes: Provide door hardware of same finish, unless otherwise indicated.
1. Primary Finish: 625; bright chromium plated over nickel, with brass or bronze base material (former US equivalent US26); BHMA A156.18.
2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
3. Exceptions:
a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
b. Hinges for Fire-Rated Doors: Steel base material with painted finish, in compliance with NFPA 80.
c. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
d. Hardware for Aluminum Entrance Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Install hardware for smoke and draft control doors in accordance with NFPA 105.

D. Use templates provided by hardware item manufacturer.

E. Do not install surface mounted items until application of finishes to substrate are fully completed.

F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. Mounting heights in compliance with ADA Standards:
      a. Locksets: 40-5/16 inch (1024 mm).
      b. Push Plates/Pull Bars: 42 inch (1067 mm).
      c. Deadlocks (Deadbolts): 48 inch (1219 mm).
      d. Exit Devices: 40-5/16 inch (1024 mm).
      e. Door Viewer: 43 inch (1092 mm); standard height 60 inch (1524 mm).

G. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

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SECTION 08 71 13
POWER DOOR OPERATORS

PART 2 PRODUCTS

1.01 POWER DOOR OPERATORS - GENERAL

A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.

B. Comply with ADA Standards for egress requirements.

C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for light pedestrian traffic unless otherwise indicated.

END OF SECTION

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SECTION 08 80 00
GLAZING

PART 2 PRODUCTS

1.01 GLASS MATERIALS

END OF SECTION

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SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Cementitious backing board.

G. Gypsum wallboard.

H. Joint treatment and accessories.

I. Plenum space sound control.

J. Noise barriers in gypsum board assemblies.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

E. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

F. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.

G. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

J. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

K. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

L. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).

M. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

N. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

O. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

P. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

Q. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

R. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

S. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

T. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

U. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.

V. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).

W. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

X. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.

Y. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, with Editorial Revision (2020).

Z. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

AA. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

BB. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

CC. ASTM E413 - Classification for Rating Sound Insulation; 2022.

DD. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

EE. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

FF. UL (FRD) - Fire Resistance Directory; Current Edition.

GG. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Sequencing: Install service utilities in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
   2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

B. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions, erection drawings, and shop drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions in accordance with ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
   1. Local authorities having jurisdiction.

D. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire-Resistance-Rated Partitions: UL listed assembly No. _____; ___ hour rating.
   2. Fire-Resistance-Rated Area Separation Walls: UL listed assembly No. _____; ___ hour rating.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Material and Product Requirements Criteria: AISI S201.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

C. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: C-shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.

D. Area Separation Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.

E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.

G. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

H. Non-structural Framing Accessories:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

I. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
2. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.
3. USG Corporation: www.usg.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
5. Thickness:

C. Abuse Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Surface Abrasion: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
7. Glass Mat-Faced Type: Gypsum wallboard, as defined in ASTM C1658/C1658M.
8. Type: Fire-resistance-rated Type X, UL or WH listed.
9. Thickness: 5/8 inch (16 mm).
10. Edges: Tapered.

D. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas, including manufactured housing, tub and shower surrounds, and shower ceilings.
2. Application: Horizontal surfaces behind tile in wet areas including countertops and _____.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

4. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    a. Thickness: 1/2 inch (13 mm).

2.04 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness as required for STC.

B. Fire and Sound Attenuating Insulation: Sprayed cellulose fire-rated material for cavities in wall assemblies.
    1. Surface Burning Characteristics: Provide assemblies with Class I rating, when tested in accordance with ASTM E84.
    2. Sound Transmission Class (STC): 56, calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

D. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
    1. Types: As detailed or required for finished appearance.
    2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

E. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
    1. Corner Beads: Low profile, for 90 degree outside corners.
    2. Expansion Joints:
        a. Fire-Resistance Rated: 1 hour when joint system tested in accordance with UL 2079.
        b. Type: V-shaped PVC with tear away fins.
        c. Type: V-shaped metal with factory-installed protective tape.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
    1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
    2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
    3. Joint Compound: Drying type, vinyl-based, ready-mixed.
    4. Joint Compound: Setting type, field-mixed.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

I. Nails for Attachment to Wood Members: ASTM C514.

J. Staples For Attachment of Base Ply of Two-Ply Assembly to Wood Members: Flattened galvanized wire type as specified in ASTM C840.

K. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

L. Adhesive for Attachment to Wood, ASTM C557 and Metal:

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

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

C. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

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

E. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

F. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

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

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

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

C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
   1. Single-Layer Applications: Adhesive application.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

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

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

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

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
   2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.

3.07 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean _____.

3.08 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

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SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Tile for counters.

D. Coated glass mat backer board as tile substrate.

E. Stone thresholds.

F. Ceramic accessories.

G. Ceramic trim.

H. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

C. Section 22 40 00 - Plumbing Fixtures: Shower receptor.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2019.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.

C. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.

D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.

F. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2019).

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

L. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).

N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

O. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

P. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.

Q. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.

R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).

S. ANSI A118.13 - American National Standard Specification for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation; 2014 (Reaffirmed 2019).

T. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.

U. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine; 2022.

V. ASTM E2179 - Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors; 2021.

W. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

X. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

Y. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

Z. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2024.

AA. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

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

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

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installer's Qualification Statement:
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation; www.tile-assn.com/#sle

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications: Natural Stone Institute (NSI) Accredited Commercial B Contractor (light commercial): www.naturalstoneinstitute.org/#sle.

D. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

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

1.08 FIELD CONDITIONS

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

B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. American Olean Corporation; _____: www.americanolean.com/#sle.
   2. Architessa; _____: www.architessa.com/#sle.
   3. Dal-Tile Corporation; _____: www.daltile.com/#sle.
   4. Emser Tile, LLC; _____: www.emser.com/#sle.
   5. Florim USA; _____: www.milestonetiles.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
   1. Applications:
      a. Open Edges: Bullnose.
      b. Inside Corners: Jointed.
      c. Floor to Wall Joints: Cove base.
   2. Manufacturers: Same as for tile.

C. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, set with tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall and floor tile.
      b. Inside and outside wall corners.
      c. Transition between floor finishes of different heights.
      d. Thresholds at door openings.

e. Floor and wall expansion and control joints.
f. Floor-to-wall joints.
g. Borders and other trim as indicated on drawings.
h. Balcony and terrace edge trim and fascia.

2. Products:
a. Blanke Corporation; Blanke - Trims and Profiles: www.blankecorp.com/#sle.
b. Genesis APS International; _____: www.genesis-aps.com/#sle.
c. LATICRETE International, Inc; ____: www.laticrete.com/#sle.
d. Schluter-Systems; Schiene: www.schluter.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Thresholds: 2 inches (51 mm) wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
1. Thickness: 1/2 inch (12.7 mm).
2. Material: Marble, honed finish.
3. Material: Solid surface acrylic resin, mineral filler, and pigments; non-porous, color and pattern consistent throughout thickness.
4. Material: Artificial stone tile; 93 percent quartz aggregate, resin, color pigments.
5. Color and Pattern: As indicated on drawings.
6. Applications:
a. At doorways where tile terminates.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:
1. ARDEX Engineered Cements; _____: www.ardexamericas.com/#sle.
2. Bostik Inc; _____: www.bostik-us.com/#sle.
3. Custom Building Products; _____: www.custombuildingproducts.com/#sle.
4. H.B. Fuller Construction Products, Inc; ____: www.tecspecialty.com/#sle.
5. Mapei Corporation; _____: www.mapei.com/#sle.
6. Merkrete, by Parex USA, Inc; _____: www.merkrete.com/#sle.
7. Schluter-Systems; ____: www.schluter.com/#sle.
8. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:
1. ARDEX Engineered Cements; _____: www.ardexamericas.com/#sle.
2. Bostik Inc; _____: www.bostik-us.com/#sle.
3. Custom Building Products; _____: www.custombuildingproducts.com/#sle.
4. H.B. Fuller Construction Products, Inc; _____: www.tecspecialty.com/#sle.
5. LATICRETE International, Inc; _____: www.laticrete.com/#sle.
6. Mapei Corporation; _____: www.mapei.com/#sle.
7. Litokol USA; _____: www.tiledoctor.com/#sle.
8. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: www.merkrete.com/#sle.
9. Substitutions: See Section 01 60 00 - Product Requirements.

C. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
3. Color(s): As selected by Architect from manufacturer's full line.

4. Color(s): As indicated on drawings.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
   1. Applications: Between tile and plumbing fixtures.
   2. Color(s): As selected by Architect from manufacturer's full line.
   3. Color(s): As indicated on drawings.
   4. Products:
      a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
      b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
      c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
      d. Mapei Corporation; Mapesil T Plus: www.mapei.com/#sle.
      e. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com/#sle.
      f. Rust-Oleum Corporation; _____: www.rustoleum.com/#sle.
      g. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 20 mils (0.5 mm), maximum.
      c. Products:
         1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
         2) LATICRETE International, Inc; LATICRETE FRACTURE BAN SC: www.laticrete.com/#sle.
         3) Mapei Corporation; Mapelastic CI: www.mapei.com/#sle.
         4) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
         5) Sika Corp; SikaTile 200 Fracture Guard Rapid: www.sika.com/#sle.
         6) Substitutions: See Section 01 60 00 - Product Requirements.
   3. Bonded Sheet Membrane Type:
      a. Material: Polyethylene sheet membrane with polyester fleece laminated to underside, 20 mils (0.5 mm) thick.
      b. Products:
         1) Schluter-Systems; DITRA: www.schluter.com/#sle.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 25 mils (0.6 mm), minimum, dry film thickness.
      c. Products:
         1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
         2) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com/#sle.
         3) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.

4) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
5) Substitutions: See Section 01 60 00 - Product Requirements.

C. Waterproofing Tape: Rubber tape for reinforcing and sealing joints in sheet waterproofing membranes.
1. Products:
a. Mapei Corporation; Mapeband: www.mapei.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Reinforcing Underlayment: Specifically designed for bonding to thin-set setting mortar; not primarily waterproofing material and having the following characteristics:
1. Sound Reduction: Comply with ANSI A118.13, ASTM E492, and ASTM E2179.
2. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
3. Water Resistance: Comply with ANSI A118.10, bonded waterproofing.
4. Uncoupling Function: Allow for separation between membrane and mortar adhering tile to membrane when subjected to excessive substrate movement.
5. Suitable for installation over green concrete.
6. Type: Fluid or Trowel Applied.
a. Products:
1) LATICRETE International, Inc; LATICRETE 125 Sound and Crack Adhesive: www.laticrete.com/#sle.
2) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
3) Proflex Products, Inc; Hydra-Seal: www.proflex.us/#sle.
4) Substitutions: See Section 01 60 00 - Product Requirements.

E. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
1. Standard Type: Thickness 1/2 inch (12.7 mm).

F. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
1. Test in accordance with Section 09 05 61.
2. Test as Follows:
a. Alkalinity (pH): ASTM F710.
b. Internal Relative Humidity: ASTM F2170.
c. Moisture Vapor Emission: ASTM F1869.
3. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
4. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

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

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout.
   1. Use uncoupling membrane under all tile unless other underlayment is indicated.
   2. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.

3.05 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
   1. Where mortar bed is indicated, install in accordance with TCNA (HB) Method W222, one coat method.
   2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCNA (HB) Method W222, one coat method.

C. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

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

3.08 SCHEDULE

A. Restroom, Janitor Room, and Locker Room Floors:
   1. Tile: Ceramic mosaic.
   2. Base: Coved, 2 inches (51 mm) high, bullnosed top edge.
   3. Installation Method: Mortar bed.
   4. Grout: Silicone rubber.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers; 1998 (Reapproved 2023).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2023.

D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

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

E. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: _____ square feet (_____ square meters) of each type and color.
   3. Extra Wall Base: _____ linear feet (_____ linear meters) of each type and color.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

D. Do not double stack pallets.

1.06 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 TILE FLOORING

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, loose laid with edges and control grid adhered.

B. Removal of existing carpet tile.

C. Matching roll carpet for direct glue installation on base, stairs, and _____.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

E. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Accessory Samples: Submit two ____ inch (____ mm) long samples of edge strip, base cap, stair nosing, and _____.

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

G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
   1. As shown on drawings.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting: Tufted, manufactured in one color dye lot.

B. Roll Carpet: Same manufacturer, type, color and pattern, and face fiber characteristics as carpet tile, ____ feet (____ m) wide, manufactured in same color dye lot as tile.

2.03 ACCESSORIES

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

B. Base Cap: _____ type, _____ finish, _____ color.

C. Edge Strips: Embossed aluminum, _____ color.

D. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content as specified in Section 01 61 16.
   2. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

E. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 05 61.
   2. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   3. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
   4. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing carpet tile.

B. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

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

D. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

E. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

F. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Adhere carpet tile to substrate along centerline of rooms, at perimeter of rooms, where tiles are cut, and at 15 foot (4.5 m) intervals throughout rooms. Lay remainder of tile dry over substrate.

I. Adhere carpet tile as base finish up vertical surfaces to form base. Terminate top of base with cap strip.

J. Trim carpet tile neatly at walls and around interruptions.

K. Complete installation of edge strips, concealing exposed edges.

3.04 INSTALLATION ON STAIRS

A. Use one piece of carpet for each tread and the riser below. Apply seam adhesive to all cut edges.

B. Lay carpet with pile direction in the length of the stair.

C. Adhere carpet tight to stair treads and risers.

3.05 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

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

C. Clean and vacuum carpet surfaces.

END OF SECTION

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SECTION 09 90 00
PAINTING AND COATING - COMMERCIAL FACILITY GUIDE SPECIFICATION - SHERWIN-WILLIAMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Interior painting and coating systems.

C. Scope:
   1. Finish surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
      a. Interior:
         1) Concrete, Walls and Ceilings: Poured concrete, precast concrete, unglazed brick, cement board, tilt-up, cast-in-place concrete, and plaster.
         2) Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
         3) Metal: Aluminum and galvanized.
         4) Metal, Galvanized: Ceilings and ductwork.
         5) Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and ferrous metal.
         6) Wood: Walls, ceilings, doors, and trim.
         7) Drywall: Walls, ceilings, gypsum board, and similar items.
         8) Concrete: Floors, non-vehicular.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

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

B. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

D. SSPC-SP 2 - Hand Tool Cleaning; 2018.

E. SSPC-SP 3 - Power Tool Cleaning; 2018.

F. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Product characteristics.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification.
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Clean-up information.

C. Samples: Submit four paper draw down samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Applicator's qualification statement.

F. Maintenance Data: Submit coating maintenance manual including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets

(SDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
   3. Label each container with color in addition to manufacturer's label.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

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

B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.

C. Paint Materials: Store at a minimum of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

D. Handling: Maintain a clean, dry storage area to prevent contamination or damage to materials.

1.07 FIELD CONDITIONS

A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Products: Subject to compliance with requirements, provide Sherwin-Williams Company (The) products indicated; www.sherwin-williams.com/#sle.

B. Comparable Products: Products of approved manufacturers will be considered in accordance with 01 60 00 - Product Requirements, and the following:
   1. Products are approved by manufacturer in writing for application specified.
   2. Products that meet or exceed performance and physical characteristics of basis of design products.

2.02 PAINTINGS AND COATINGS

A. General:
   1. Provide factory-mixed coatings unless otherwise indicated.
   2. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application.
   3. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.

B. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

2.03 PAINT SYSTEMS - INTERIOR

A. Concrete, Walls and Ceilings: Poured concrete, precast concrete, unglazed brick, cement board, tilt-up, cast-in-place concrete, and plaster.
   1. Latex Systems:
      a. Semi-Gloss Finish Scuff Resistant Waterbase Enamel:

1) 1st Coat: Sherwin-Williams Loxon Concrete and Masonry Primer Sealer, LX02W50 Series: www.sherwin-williams.com/#sle.
(a) 8 mils wet, 3.2 mils dry per coat.
2) 2nd and 3rd Coat: Sherwin-Williams Scuff Tuff Interior Waterbased Enamel, Semi-Gloss, S26-50 Series: www.sherwin-williams.com/#sle.
(a) 4 mils wet, 1.2 mils dry per coat.

B. Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.

C. Metal, Galvanized: Ceilings and ductwork.
1. Multi-Surface Acrylic Coating System:
a. Gloss Finish High Performance:
1) 1st and 2nd Coat: Sherwin-Williams Pro Industrial Multi-Surface Acrylic, B66-1500 Series: www.sherwin-williams.com/#sle.

D. Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and ferrous metal.
1. Latex Systems:
a. Semi-Gloss High Performance:
1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series: www.sherwin-williams.com/#sle.

E. Wood: Walls, ceilings, doors, and trim.
1. Latex Systems:
a. Semi-Gloss Finish:
1) 1st Coat: Sherwin-Williams Premium Wall and Wood Primer, B28W8111: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams ProClassic Waterborne Acrylic Semi-Gloss, B31 Series: www.sherwin-williams.com/#sle.

F. Drywall: Walls, ceilings, gypsum board, and similar items.
1. Latex Systems:
a. Semi-Gloss Finish:
1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series: www.sherwin-williams.com/#sle.
b. Semi-Gloss Finish Scuff Resistant Waterbase Enamel:
1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams Scuff Tuff Interior Waterbased Enamel, Semi-Gloss, S26-50 Series: www.sherwin-williams.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove mildew from impervious surfaces by scrubbing with solution of water and bleach. Rinse with clean water and allow surface to dry.

D. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk.
   2. Fill bug holes, air pockets, and other voids with cement patching compound.
   3. Prepare concrete in accordance with SSPC-SP 13/NACE No.6.

E. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.

F. Plaster: Fill hairline cracks, small holes, and imperfections with patching plaster. Make smooth and flush with adjacent surfaces. Treat textured, soft, porous, or powdery surfaces in accordance with manufacturer's instructions.

G. Concrete Floors and Traffic Surfaces: Prepare concrete in accordance with SSPC-SP 13/NACE No.6.

H. Aluminum: Remove surface contamination and oil; wash with solvent according to SSPC-SP 1.

I. Wood: Remove dust, grit, and foreign matter. Scrape, sand, and spot prime knots and pitch streaks. Fill nail holes and imperfections with wood filler and sand smooth.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness.

D. Regardless of number of coats specified, apply additional coats until complete hide is achieved.

3.04 PRIMING

A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to top coat manufacturers.

3.05 CLEANING

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

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 21 13.13
METAL TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal toilet compartments.

B. Urinal and Vestibule screens.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

B. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, 12"x12" inch (____x____ mm) in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Toilet Compartments:
   1. All American Metal Corp - AAMCO; Stainless Steel: www.allamericanmetal.com/#sle.
   2. ASI Accurate Partitions; Stainless Steel: www.asi-accuratepartitions.com/#sle.
   3. ASI Global Partitions; Stainless Steel: www.asi-globalpartitions.com/#sle.
   4. Hadrian; Hadrian - Standard Series - Powder Coated: www.hadrian-inc.com/#sle.
   5. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

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

B. Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel.

C. Stainless Steel Sheet: ASTM A666, Type 304.

2.03 COMPONENTS

A. Toilet Compartments: Baked enamelled or powder coated steel, ceiling-hung.

B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound-deadening core, corners made with corner clips or mitered, welded, and ground smooth.
   1. Panel Faces: 22 gauge, 0.0299 inch (0.76 mm).
   2. Door Faces: 22 gauge, 0.0299 inch (0.76 mm).

3. Pilaster Faces: 22 gauge, 0.0299 inch (0.76 mm).
4. Reinforcement: 12 gauge, 0.1046 inch (2.66 mm).
5. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

C. Door and Panel Dimensions:
1. Thickness: 1 inch (25 mm).
2. Door Width: 24 inches (610 mm).
3. Door Width for Handicapped Use: 36 inch (915 mm) , out-swinging.
4. Height: 63-1/2 inches (1613 mm).

D. Urinal Screens: Wall mounted with two panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling.

2.04 ACCESSORIES

A. Head Rails: Hollow anodized aluminum tube, 1 by 1-5/8 inches (25 by 41 mm) in size, with anti-grip strips and cast socket wall brackets.

B. Brackets: Polished chrome-plated non-ferrous cast metal.

C. Attachments, Screws, and Bolts: Chrome-plated steel, tamper-proof type.
1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

D. Hardware: Polished chrome plated non-ferrous cast metal:
1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
2. Nylon bearings.
3. Thumb turn or sliding door latch with exterior emergency access feature.
4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
5. Coat hook with rubber bumper; one per compartment, mounted on door.
6. Provide door pull for outswinging doors.

2.05 FINISHING

A. Powder-Coated Steel Compartments: Manufacturer's standard process. Clean, degrease, and neutralize.

B. Baked Enamel Steel Compartments: Manufacturer's standard process. Clean, degrease, and neutralize. Follow immediately with phosphatizing treatment, prime coat, and two finish coats.

C. Color: Single color as selected.

D. Stainless Steel Compartments: No. 4 finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that field measurements are as indicated.

C. Verify correct spacing of and between plumbing fixtures.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch (9 to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged enamel finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

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SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Under-lavatory pipe supply covers.

D. Electric hand/hair dryers.

E. Diaper changing stations.

F. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 30 00 - Tiling: Ceramic washroom accessories.

B. Section 10 21 13.13 - Metal Toilet Compartments.

C. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 ABBREVIATIONS AND ACRONYMS

A. PETG: Polyethylene Terephthalate Glycol.

B. PPE: Personal Protective Equipment.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

G. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2023.

H. ASTM C1036 - Standard Specification for Flat Glass; 2021.

I. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

J. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

K. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

L. ASTM D4802 - Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet; 2016.

M. ASTM D5047 - Standard Specification for Polyethylene Terephthalate Film and Sheeting; 2017.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

O. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.

P. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

Q. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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

C. Samples: Submit two samples of each accessory, illustrating color and finish.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
   2. Bradley Corporation; _____: www.bradleycorp.com/#sle.
   3. Georgia-Pacific Professional; _____: www.gppro.com/#sle.
   4. Kimberly-Clark Corporation; Kimberly-Clark Professional ICON Collection: www.kcprofessional.com/#sle.
   5. Palmer Fixture; _____: www.palmerfixture.com/#sle.
   6. Substitutions: Section 01 60 00 - Product Requirements.

B. Residential Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
   2. Ginger by Brasstech Inc; _____: www.gingerco.com/#sle.
   3. Pamex Inc; _____: www.pamexinc.com/#sle.
   4. Seachrome Corporation; _____: www.seachrome.com/#sle.
   5. Substitutions: Section 01 60 00 - Product Requirements.

C. Under-Lavatory Pipe Supply Covers:
   1. Plumberex Specialty Products, Inc; _____: www.plumberex.com/#sle.
   2. Substitutions: Section 01 60 00 - Product Requirements.

D. Electric Hand/Hair Dryers:
   1. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
   2. Dyson Inc; Dyson Airblade 9kJ: www.dyson.com/#sle.
   3. Excel Dryer; _____: www.exceldryer.com/#sle.
   4. Frost Products Limited; _____: www.frostproductsltd.com/#sle.
   5. Mitsubishi Electric Trane HVAC US LLC; _____: www.mitsubishielectric.com/#sle.
   6. Stelpro Design Inc; ELN - El-Nino Hand Dryer: www.stelpro.com/#sle.
   7. World Dryer Corporation; _____: www.worlddryer.com/#sle.
   8. Substitutions: Section 01 60 00 - Product Requirements.

E. Diaper Changing Stations:
   1. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
   2. Bradley Corporation; _____: www.bradleycorp.com/#sle.
   3. Diaper Deck & Company; _____: www.diaperdeck.com/#sle.
   4. Foundations Worldwide, Inc; _____: www.foundations.com/#sle.
   5. Koala Kare Products; _____: www.koalabear.com/#sle.
   6. Safe-Strap Company, Inc; _____: www.diaperdepot.com/#sle.

7. Substitutions: 01 60 00 - Product Requirements.

F. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide _____ keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

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

F. Zinc Alloy: Die cast, ASTM B86.

G. Acrylic Plastic Sheet: ASTM D4802.

H. PETG Plastic Sheet: ASTM D5047.

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

J. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

K. Adhesive: Two component epoxy type, waterproof.

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

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

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

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

C. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.

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

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: Single roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
   1. Attached Purse Shelf: 0.03 inch (0.8 mm) satin finished stainless steel, with rolled or formed edge at front.
   2. Products:
      a. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
      b. Substitutions: Section 01 60 00 - Product Requirements.

B. Paper Towel Dispenser: Folded paper type, thermoplastic polymer, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 500 multifold minimum.
   2. Products:
      a. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
      b. Substitutions: Section 01 60 00 - Product Requirements.

C. Combination Towel Dispenser/Waste Receptacle: Recessed flush with wall, stainless steel; seamless wall flanges, continuous piano hinges, ____.
   1. Waste receptacle liner: Reusable, heavy-duty vinyl.
   2. Towel dispenser capacity: 400 C-fold.
   3. Waste receptacle capacity: 4 gallons (15 liters).
   4. Products:
      a. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
      b. Substitutions: Section 01 60 00 - Product Requirements.

D. Automated Soap Dispenser: Foam soap dispenser, deck-mounted on vanity, with container concealed below deck; chrome-plated brass with bright polished finish; chrome-plated deck escutcheon.
   1. Minimum Capacity: 27 ounces (0.80 liters).
   2. Power: Battery operated.
   3. Products:
      a. Advanced Modern Technologies Corporation; _____: www.amtcorporation.com/#sle.
      b. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
      c. Stern Engineering; Extreme Soap Dispenser Series: www.sternfaucets.com/#sle.
      d. Kimberly-Clark Corporation; Kimberly-Clark Professional Scott Counter Mount Skin Care Dispenser: www.kcprofessional.com/#sle.
      e. Substitutions: Section 01 60 00 - Product Requirements.

E. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Frame: 0.05 inch (1.3 mm)angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.
   4. Products:
      a. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
      b. Ketcham Medicine Cabinets, a Division of Fred Silver and Company, Inc; Washroom Mirrors: www.ketchamcabinets.com/#sle.

F. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.
   1. Minimum capacity: 250 seat covers.
   2. Products:
      a. Kimberly-Clark Corporation; Kimberly-Clark Professional Scott Personal Seat Cover Dispenser: www.kcprofessional.com/#sle.
      b. Substitutions: Section 01 60 00 - Product Requirements.

G. Grab Bars: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
      b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
      c. Finish: Satin.
      d. Length and Configuration: As indicated on drawings.
      e. Products:
         1) American Specialties, Inc; _____: www.americanspecialties.com/#sle.
         2) PROFLO; PFGB12SF4 - PROFLO 12 inch Stainless Steel Grab Bar in Satin: www.ferguson.com/#sle.

3) Seachrome Corporation; Straight Grab Bars, Model _____: www.seachrome.com/#sle.
4) Substitutions: Section 01 60 00 - Product Requirements.

H. Combination Sanitary Napkin/Tampon Dispenser with Disposal: Stainless steel, surface-mounted.
1. Door: Seamless 0.05 inch (1.3 mm) door with returned edges and tumbler lock.
2. Cabinet: Fully welded, 0.03 inch (0.8 mm) thick sheet.
3. Operation: No charge; no coin slots.
4. Operation: 25 cent coin required to operate dispenser. Provide locked coin box, separately keyed.
5. Identify dispensers slots without using brand names.
6. Minimum capacity: 15 napkins and 20 tampons.
7. Products:
a. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
b. Substitutions: Section 01 60 00 - Product Requirements.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1 inch (25 mm) outside diameter, 0.04 inch (1.0 mm) wall thickness, satin-finished, with 3 inch (75 mm) outside diameter, minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges, for installation with exposed fasteners.
1. Products:
a. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
b. Substitutions: Section 01 60 00 - Product Requirements.

B. Shower Curtain:
1. Material: Opaque vinyl, 0.008 inch (0.2 mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
2. Material: Cotton, machine washable, and mildew-resistant.
3. Size: 36 by 72 inches (914 by 1830 mm), hemmed edges.
4. Grommets: Stainless steel; pierced through top hem on 6 inch (150 mm) centers.
5. Color: White.
6. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.

C. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of ____ color.
2. Seat: One-piece, pan-type, 0.05 inch (1.3 mm) stainless steel sheet, Type 304. Weld seams and grind smooth.
3. Seat: Teakwood slats secured to supporting frame members with stainless steel screws. Ease edges of each slat.
4. Seat: Closed-cell foam rubber with vinyl-coated fabric cover, with sealed seams, of ____ color.
5. Size: ADA Standards compliant.
6. Products:
a. Seachrome Corporation; Accessibility Seats, L-Shaped Transfer with Swing-down Legs, Reversible: www.seachrome.com/#sle.
b. Substitutions: Section 01 60 00 - Product Requirements.

D. Towel Bar: Stainless steel, 3/4 inch (20 mm) square tubular bar; rectangular brackets, concealed attachment, satin finish.
1. Length: 18 inches (460 mm).

E. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Specified in 22 40 00 - Plumbing Fixtures.

B. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
   2. Construction: 1/8 inch (3.2 mm) flexible PVC.
      a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
      b. Comply with ASTM C1822, type indicated.
      c. Comply with ASME A112.18.9.
      d. Comply with ICC A117.1.
      e. Microbial and Fungal Resistance: Comply with ASTM G21.
   3. Color: White.
   4. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
   5. Products:
      a. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: www.plumberex.com/#sle.
      b. Plumberex Specialty Products, Inc; Plumberex Trap Gear: www.plumberex.com/#sle.
      c. Plumberex Specialty Products, Inc; Plumberex Pro-Extreme: www.plumberex.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 ELECTRIC HAND/HAIR DRYERS

A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
   1. Operation: Automatic, sensor-operated on and off.
   2. Mounting: Wall-mounted - surface.
   3. Cover: Plastic.
      a. Color: White.
      b. Tamper-resistant screw attachment of cover to mounting plate.
      c. Screened or shielded air intake.
      d. Screen or shield to prevent access to motor/heater.
   4. Air Velocity: 18,000 linear feet per minute (91 m/s), minimum, at full power.
   5. Heater: 500 W, minimum, at full power.
   6. Fan/Heater Control: Field adjustable down to approximately half-speed with corresponding reduction in heat output.
   7. Total Wattage: 1400 W, maximum.
   8. Runtime: Field adjustable or automatic, up to 35 seconds.
   9. Air sanitizing and deodorizing without use of chemicals.

2.08 DIAPER CHANGING STATIONS

A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Material: Polyethylene.
   2. Mounting: Surface.
   3. Color: Gray.
   4. Minimum Rated Load: 250 pounds (113.4 kg).
   5. Products:
      a. Foundations Worldwide, Inc; Classic Baby Changing Station with Stainless Frame: www.foundations.com/#sle.
      b. Rubbermaid Commercial Products; FG781988 Baby Changing Station Vertical: www.rubbermaidcommercial.com/#sle.
      c. Substitutions: 01 60 00 - Product Requirements.

2.09 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, hat-shaped channel.
   1. Holders: Three spring-loaded rubber cam holders.
   2. Length: 36 inches (900 mm).
   3. Length: Manufacturer's standard length for number of holders.
   4. Products:
      a. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
      b. Rubbermaid Commercial Products; FG199300 Closet Organizer/Tool Holder Kit: www.rubbermaidcommercial.com/#sle.
      c. Substitutions: 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

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

E. See Section _____ for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

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

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

3.03 INSTALLATION

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

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

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.
   2. Mirrors: _____ inch (_____ mm), measured from floor to bottom of mirrored surface.
   3. Electric Hand Dryers: Measured from floor to bottom of nozzle:
      a. Men: 44 inches (1110 mm).
      b. Women: 42 inches (1060 mm).
      c. Teenager: 41 inches (1035 mm).
      d. Child: 32 inches (810 mm).
      e. Handicap: 36 inches (910 mm).
   4. Other Accessories: As indicated on drawings.

3.04 PROTECTION

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

END OF SECTION

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SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 91 23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

B. FM (AG) - FM Approval Guide; Current Edition.

C. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.05 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
   2. Ansul, a Tyco Business; ____: www.ansul.com/#sle.
   3. Fire-End & Croker Corporation: www.croker.com/#sle.
   4. Kidde, a unit of United Technologies Corp; _____: www.kidde.com/#sle.
   5. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
   6. Potter-Roemer; _____: www.potterroemer.com/#sle.
   7. Pyro-Chem, a Tyco Business; _____: www.pyrochem.com/#sle.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: www.activarcpg.com/#sle.
   2. Fire-End & Croker Corporation: www.croker.com/#sle.
   3. Kidde, a unit of United Technologies Corp; _____: www.kidde.com/#sle.
   4. Larsen's Manufacturing Co; _____: www.larsensmfg.com/#sle.
   5. Oval Brand Fire Products; Cabinets for Low Profile Extinguishers: www.ovalfireproducts.com/#sle.
   6. Potter-Roemer; _____: www.potterroemer.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

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

1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 20 pound (9.1 kg).
   3. Size and classification as scheduled.
   4. Finish: Baked polyester powder coat, ____ color.
   5. Temperature range: Minus 65 degrees F (Minus 54 degrees C) to ___ degrees F (___ degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Cabinet Construction: Non-fire rated.
   1. Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

C. Fire Rated Cabinet Construction: One-hour fire rated.

D. Cabinet Configuration: Semi-recessed type.
   1. Size to accommodate accessories.
   2. Trimless type.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

E. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

F. Door Glazing: Float glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.

G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

H. Fabrication: Weld, fill, and grind components smooth.

I. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

J. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, ____ inches (____ mm) from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

E. Position cabinet signage at _____.

3.03 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

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SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall panels for architectural cabinet work.

C. Wall-hung counters and vanity tops.

D. Sinks molded into countertops.

1.02 RELATED REQUIREMENTS

A. Section 09 30 00 - Tiling: Tile for countertops.

B. Section 12 32 00 - Manufactured Wood Casework.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

C. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. AWI (QCP) - Quality Certification Program; Current Edition.

F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

G. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

H. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

I. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

J. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.

K. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Sustainable Design Submittal: Documentation for sustainably harvested wood-based components.

G. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

H. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

I. NSI Fabricator Qualification: Documentation of Natural Stone Institute Accreditation.

J. Installer's qualification statement.

K. Installation Instructions: Manufacturer's installation instructions and recommendations.

L. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

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

B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
   2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   3. Provide designated labels on shop drawings as required by certification program.
   4. Provide designated labels on installed products as required by certification program.
   5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet, Type ___: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
      a. Manufacturers:
         1) As specified on drawings..
         2) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. NSF approved for food contact.
      d. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
      e. Laminate Core Color: Same as decorative surface.
      f. Finish: Matte or suede, gloss rating of 5 to 20.
      g. Surface Color and Pattern: As indicated on drawings.
   2. Exposed Edge Treatment: Postformed laminate; front edge substrate built up to minimum 1-1/4 inch (32 mm) thick with raised radiused edge, integral coved backsplash with radiused top edge.
   3. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch (32 mm) thick; covered with matching laminate.
   4. Exposed Edge Treatment: Molded rubber edge with T-spline, sized to completely cover edge of panel.

a. Color: As indicated on drawings.
b. Color: As selected by Architect from the manufacturer's full line.

5. Back and End Splashes: Same material, same construction.
6. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.
7. Fabricate in accordance with manufacturer's standard requirements.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
a. Manufacturers:
1) As specified on drawings..
2) Substitutions: See Section 01 60 00 - Product Requirements.
b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
c. NSF approved for food contact.
d. Sinks and Bowls: Integral castings; minimum 3/4 inch (19 mm) wall thickness; comply with IAPMO Z124.
e. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
f. Color and Pattern: As indicated on drawings.
g. Color and Pattern: As selected by Architect from manufacturer's full line.
3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
6. Skirts: As indicated on drawings.
7. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.
8. Fabricate in accordance with manufacturer's standard requirements.

C. Solid Surfacing Wall Panels: Solid surfacing sheet or plastic resin casting over continuous substrate.
1. Flat Sheet Thickness: 1/4 inch (6 mm), minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
a. Manufacturers:
1) As specified on drawings..
2) Substitutions: See Section 01 60 00 - Product Requirements.
b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
d. Color and Pattern: As indicated on drawings.
e. Color and Pattern: As selected by Architect from manufacturer's full line.
3. Fabricate in accordance with manufacturer's standard requirements.

2.02 MATERIALS

A. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

C. Cove Molding for Top of Splashes: Rubber with semi-gloss finish and T-spline to fit between splash and wall; 1/2 inch (12 mm) by 1/2 inch (12 mm).
   1. Color: As indicated on drawings.
   2. Color: As selected by Architect from manufacturer's full line.

D. Joint Sealant: Mildew-resistant silicone sealant, white.

2.03 ACCESSORIES

A. Fixed Top-Mounted Countertop Support Brackets:
   1. Material: Steel.
   2. Finish: Manufacturer's standard, factory-applied, textured powder coat.

2.04 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
   1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

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

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).

C. Seal joint between back/end splashes and vertical surfaces.

1. Where indicated use rubber cove molding.
2. Where applied cove molding is not indicated use specified sealant.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

SECTION 20 00 10 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.01 DESCRIPTION OF WORK:

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1 and form a part of and shall govern all work performed under these specifications

B. These specifications, contract documents, and attached drawings are issued as part of this specification. Any requirements shown herein are equally affective as if included in this specification. Omissions in this specification or on the contract documents shall not be a basis for failure on the part of the contractor, from installing all components required for a complete and operable system. Should any system or portion of work called for within these specifications or on the contract documents in such a manner that the Contractor cannot, in his judgment, comply with the requirements, then the Contractor shall bring the matter to the attention of the Engineer prior to proceeding with the work.

C. The Contract Documents depict the scheduled equipment and components as a basis of design. Should the Contractor submit and receive approval for equipment that is acceptable by specification, but differs from that of the basis of design, the Contractor shall be responsible for coordination of that equipment with all other trades. Costs incurred to provide increased service to or from said piece of equipment or system shall be borne by the Contractor supplying the equipment or system at no additional cost to the Owner.

D. Work includes the installation of all necessary equipment, piping, ductwork, and components for complete and operable systems.

E. This project includes the following systems:

1. Domestic Water Distribution Piping
2. Sanitary Waste, Condensate, and Vent System
3. DDC / Electric Temperature Control System

1.02 DEFINITIONS AND TERMS:

A. The word “Owner” shall be defined as the party mentioned in the prime contract agreement, or any representative of his party authorized to act in his behalf in the execution of the work.

B. The word “Contractor” shall be defined as the person, firm or corporation entering into a contract with the owner to construct and complete the work as specified herein.

C. The word “furnish” shall be defined as to supply and deliver to project site, ready for unloading, unpacking, assembly, installation and similar subsequent requirements.

D. The word “install” shall be defined as operations at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar requirements.

E. The word “provide” shall be defined as to furnish and install complete, ready for intended use as defined above.

1.03 SUBMITTALS:

A. General: Each contractor shall submit shop drawings as stated in Division 1 Sections pertaining to submission of shop drawings, product data, samples, and as specified herein.

B. Approval of shop drawings does not relieve the contractor of the responsibility for ordering proper quantities and miscellaneous appurtenances required for operation and/or installation of the respective material or equipment nor from the responsibility of complying with all elements of the Contract Documents.

C. Provide specific information with each submittal as stated in the respective specification sections.

D. The following General Information is required with each submittal as applicable.

1. Full manufacturer’s model name and number of each item
2. Equipment performance, physical size by dimension, and construction data.
3. Finishes: Provide two (2) color samples for equipment requiring color/finish selection.
4. Location of connection points for external piping, ductwork, and electrical connections.
5. Rough-in/foundation and support point dimensions.
6. Complete wiring diagrams and connection identifications.
7. Contractor’s stamp, signature and date shall be affixed to submittal drawing indicating his review and approval.

1.04 PERMITS AND INSPECTIONS:

A. The Contractor shall obtain and furnish all necessary permits and inspection certificates for all material and labor furnished by him.

B. Permits and certificates shall be obtained from the proper inspection authorities. The cost of permits, certificates and all fees required in connection with the installation shall be borne by the Contractor, unless otherwise noted in the detailed contractual description preceding these Mechanical Specifications.

C. Where applications are required for the procuring of utility services to the building, this Contractor shall see that such application is properly filed with the utility and that all information required for such an application is presented to the extent and in the form required by the utility company.

1.05 DRAWINGS:

A. The drawings and the specifications are cooperative and supplementary. It is the intent of both said drawings and specifications to cover all mechanical requirements in their entirety as nearly as possible. The Contractor shall closely check the drawings and specifications for any obvious errors or omissions, and bring any such condition to the attention of the Engineer

B. The Contractor shall have a complete set of drawings including civil, architectural, structural, mechanical and electrical drawings on the site at all times. Prior to installing any of his work, he shall check the drawings for exact dimensions and see that his work does not interfere with clearance required for beams, foundations, finished columns, pilasters, partitions, piping, ductwork, etc., as shown on the drawings and details.

C. After work is installed and it develops that interferences occur which have not been called to the Engineer's attention before the installation, the Contractor shall, at his own expense, make such changes in his work as directed by the Engineer.

D. The contract drawings for mechanical work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, piping, ductwork, etc., and approximate sizes and locations of equipment and materials.

E. Where job conditions require reasonable changes in indicated locations and arrangement, the Contractor shall make such changes as directed by the Engineer, without additional cost to the Owner.

F. Because of the scale of the drawings, certain basic items may not be shown, but where such items are required by other Sections of these specifications or where they are required by the nature of the work, they shall be furnished and installed.

G. Rough-in dimensions and locations shall be verified with the supplier of all equipment furnished by other trades or by the Owner prior to the time of roughing-in.

H. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. Minor deviations from the contract drawings may be made to allow for better accessibility, but changes of magnitude, or which involve extra cost, shall not be made without approval.

I. Ample space shall be allowed for removal of all parts that may require replacement or service in the future.

1.06 COORDINATION DRAWINGS:

A. Prepare coordination drawings for project coordination to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components.

B. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:

   a. Clearances for servicing and maintaining equipment, including tube removal, filter removal and space for equipment disassembly required for periodic maintenance.
   b. Equipment connections and support details.
   c. Exterior wall and foundation penetrations.
   d. Fire rated wall and floor penetrations.
   e. Sizes and location of required concrete pads and bases.
   f. Valve stem movement.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

1.07 RECORD DOCUMENTS:

A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices, filters, boxes, and terminal units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.).
3. Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
4. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
5. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
6. During construction, maintain a complete and legible set of drawings, showing changes and deviations between actual construction and Engineer's drawings.
7. Sheetmetal fabrication drawings shall be updated and corrected to reflect "as-built" conditions and a record set submitted to Engineer upon completion of project.

1.08 OPERATING AND MAINTENANCE MANUALS:

A. Prepare bound sets of operating and maintenance manuals in accordance with Division 1 Section "PROJECT CLOSE-OUT." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair and assembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.09 DELIVERY, STORAGE, AND HANDLING:

A. Deliver products to the project site properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. All construction related products and equipment received at project site shall be secured and stored neatly, in original packaging, and protected from the elements in an Owner designated, on-site storage area.

C. All construction related products and equipment shall be handled, moved, lifted and placed in accordance with all manufacturers' posted and written instructions. Equipment and/or product damage incurred due to improper handling shall be repaired to like new condition by the Contractor causing said damage. If the damaged item cannot be repaired to a like new condition then the item shall be replaced with new by the Contractor causing said damage at no additional cost increase in the contract amount.

1.10 CODES, FEES, AND MISCELLANEOUS COSTS:

A. All construction shall comply with all applicable specifications, codes, local ordinances, industry standards, and utility company regulations.

B. In case of variations between specifications, codes, laws, applicable regulations, and the Contract Documents, the most stringent requirement shall govern the work done. The Contractor shall Promptly notify the Engineer in writing of any such discrepancy.

C. Should the Contractor perform work that does not comply with the standards governing the construction of this project, he shall bear all costs incurred to correct work that does not comply with the set standards.

PART 2 - PRODUCTS:

NOT APPLICABLE

PART 3 - EXECUTION:

3.01 ROUGH-IN:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specification sections for rough-in requirements.

3.02 MECHANICAL INSTALLATIONS:

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

B. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

1. Furnish and install access doors in ducts at all fire damper and temperature control damper locations.
2. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
3. The Architect/Engineer reserves the right to require minor adjustments (maximum of 10'-0") in location of switches, blocking, ductwork, conduits, drains, piping, outlets, switches and/or equipment at no additional charge if so directed prior to their installation. Where the Drawings show equipment, casework, or the like, Contractors shall lay out the work to avoid conflicts. Where offsets in piping, additional fittings, necessary drains, minor valves, traps, devices, etc., are required to complete the installation, to clear obstructions or the work of other Contractors, or for the proper operation of the system, these shall be deemed to be included in the Contract and shall be furnished and installed complete by the Contractor at not additional charge.

3.03 CUTTING AND PATCHING:

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

END OF SECTION

SECTION 20 00 30 - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.02 SUMMARY:

A. This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory-installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.

B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the drawings.

1.03 RELATED DOCUMENTS:

A. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in **Division 26><Division 16>**.

1.04 REFERENCES:

A. NEMA Standards MG 1: Motors and Generators.
B. NEMA Standard ICS 2: Industrial Control Devices, Controller, and Assemblies.
C. NEMA Standard 250: Enclosures for Electrical Equipment.
D. NEMA Standard KS 1: Enclosed Switches.
E. The current edition of The National Electrical Code:

1.05 SUBMITTALS:

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.06 QUALITY ASSURANCE:

A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.01 MOTORS:

A. The following are basic requirements for simple or common motors. All motors used with variable frequency drives shall be “Premium efficiency” and shall be VFD compatible. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. 2-speed motors shall have separate windings. Motor starters shall be supplied by motor manufacturer.
3. Temperature Rating: Rated for 40 deg. C environmental with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).
4. Starting capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.
5. Service Factor: 1.15 for multiphase motors and 1.35 for single-phase motors.
6. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
   a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
   b. Bearings:
      (1) Ball or roller bearings with inner and outer shaft seals;
      (2) Greasable, except permanently sealed where motor is normally inaccessible for regular maintenance;
      (3) Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
      (4) For fractional horsepower, light duty motors, sleeve type bearings are permitted.
   c. Enclosure Type:
      (1) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
      (2) Guarded drip-proof motors where exposed to contact by employees or building occupants.
      (3) Weather protected Type I for outdoor use, Type II where not housed;
   d. Overload protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
   e. Noise rating: "Quiet".
   f. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, test method B.
   g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

2.02 STARTERS, ELECTRICAL DEVICES, AND WIRING:

A. Motor Starter Characteristics:

1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC proper class and division.

2. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.

B. Manual switches shall have:

1. Pilot lights and extra positions for multi-speed motors.
2. Overload protection: Melting alloy type thermal overload relays.

C. Magnetic Starters:

1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
2. Trip-free thermal overload relays, each phase.
3. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division-15 Controls section.
4. Built-in 120-volt control circuit transformer, fused on line and load side, where service exceeds 120 volts.
5. Externally operated manual reset.
6. Under-voltage release or protection.
7. Phase failure protection on all poly-phase motors.

D. Motor connections:

1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.03 DISCONNECT SWITCHES:

A. Fusible switches: Fused, each phase, heavy duty; horsepower rated; non-teasible quick-make, quick-break mechanism; dead front line side shield; Solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated or required for the intended duty.

B. Non-fusible switches: For equipment 2 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated or required for the duty. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

2.04 CAPACITORS:

A. Features:

1. Individual unit cells
2. All welded steel housing
3. Each capacitor internally fused
4. Non-flammable synthetic liquid impregnant
5. Craft tissue insulation
6. Aluminum foil electrodes

B. Size: KVAR size shall be as required to correct motor power factor to 90 percent or better.

PART 3 - EXECUTION:

3.01 This Contractor shall provide disconnect switches, motor starters, and other electrical devices as required by the National Electrical Code and as required for proper operation of his equipment except where specifically specified and scheduled to be provided by another trade.

3.02 Electrical equipment required for packaged mechanical equipment shall be installed in like manner as individually specified electrical equipment. Refer to Division 16 for installation requirements.

3.03 Power factor correction capacitors shall be installed on all motors 1 horsepower and larger that have an uncorrected power factor of less than 85% at rated load.

END OF SECTION

SECTION 20 00 42 - TESTING AND PROOF OF PERFORMANCE

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.01 WORK DESCRIPTION:

A. Scope of Work:

1. Perform all tests as specified herein under the supervision of the Architect/Engineer or his duly authorized representative.

B. Work Included:

1. Domestic water distribution piping
2. Sewer, soil, and waste piping system

1.02 SUBMITTALS:

A. Reports:

1. Accurately record and report the methods of testing, times, and dates of the test, witnesses to the test, and the results of the test. The test reports shall be neatly typewritten on standard 8-1/2" x 11" sheets and submitted in five (5) copies to the Architect/Engineer for approval within five (5) days after the test has been performed.

1.03 CONDITIONS:

A. Scheduling:

1. As much as practical, tests shall be scheduled so as to allow a representative from the Architect/Engineer's office to witness the test. In every case, the Architect/Engineer shall be notified a minimum of forty-eight (48) hours prior to anticipated testing.

B. Partial Testing:

1. As much as practical, systems shall be tested complete as systems. Tests on portions of a system are authorized to allow for proper progress scheduling. When systems are tested in segments, a separate and complete report is required for each segment. Segmented reports shall include a system diagram indicating portion of system tested.

C. Defective Joints:

1. All leaking joints shall be completely disassembled and remade using new materials.

D. Concealed Work:

1. Concealed Work (including underground) shall be tested and results approved by the Architect/Engineer prior to covering up.
2. Insulated work shall be tested and test to witnessed by the Architect/Engineer prior to application of the insulation.

PART 2 - PRODUCTS

2.01 TESTING EQUIPMENT:

A. Instrumentation:

1. All instruments used shall be accurately calibrated and maintained in good working condition.
2. All products and test instruments used shall be subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 TESTING PROCEDURES:

A. Domestic Water:

1. Piping shall be tested and results approved by Architect/Engineer prior to application of insulation.
2. Piping system shall be capped and subjected to a static air pressure of 50 psig above operating pressure (minimum 125 psig), and pressure maintained for 4 hours with no leaks or loss in pressure.
3. Test source shall be isolated before conducting pressure tests.

B. Storm, Soil, and Waste Piping:

1. Underground sanitary and storm piping shall be tested and results approved by the Architect/Engineer prior to covering with backfill.
2. Storm, soil, and waste piping shall be plugged and subjected to 120" static water head. Water column shall be maintained for 15 minutes with no leaks.

END OF SECTION

SECTION 20 00 60 - BASIC PIPING MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.02 DESCRIPTION OF WORK:

A. This Section specifies materials and installation methods common to Divisions 22 and includes joining materials, piping specialties, and basic piping installation instructions.

B. Products Included:
1. Piping Sleeves
2. Unions and Fittings
3. Strainers

1.03 SUBMITTALS:

A. Refer to Division 1 and Basic Mechanical Requirements for administrative and procedural requirements for submittals.

B. Product Data: Submit product data on the following items:
1. Unions and Fittings
2. Strainers

1.04 QUALITY ASSURANCE:

A. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, and clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS:

A. Refer to individual piping system Specification Sections for specifications on piping and fittings relative to that particular system.

2.02 JOINING MATERIALS:

A. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

B. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.

C. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.03 SLEEVES:

A. Sheet-Metal Sleeves: 20 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.

B. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.02 INSTALLATIONS:

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.

B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.

C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.

E. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4” threaded nipple and cap.

H. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.

I. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained. Refer to Division 7 for special sealers and materials.

3.03 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

A. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

1. Install 20 gauge galvanized sheetmetal sleeves at interior wallboard, drywall, or plasterboard partitions and ceilings other than suspended ceilings.
2. Install steel-pipe sleeves at all other penetrations and at exterior penetrations above grade.

3.04 FITTINGS AND SPECIALTIES:

3.05 JOINTS:

A. Steel Pipe Joints:

1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten joint to leave not more than 3 threads exposed.

B. Pipe Larger Than 2":

1. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.
2. Weld pipe joints of exterior water service pipe in accordance with AWWA C206.
3. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.

C. Non-ferrous Pipe Joints:

1. Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 - Standard Code for Pressure Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.

a. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered or brazed joints.
b. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.

2. Press Fittings: Copper press fittings shall be made in accordance with the manufacturer's installation instructions.
a. Tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully inserted into the fitting.
b. The joints shall be pressed using the tool approved by the manufacturer.

3. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.

D. Joints for other piping materials are specified within the respective piping system sections.

3.06 FIELD QUALITY CONTROL:

A. Testing: Refer to individual piping system specification sections.

END OF SECTION

SECTION 20 01 00 - VALVES

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.02 SUMMARY:

A. This Section includes general duty valves common to most mechanical piping systems. Special purpose valves are specified in individual piping system specifications.

1.03 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data, including body material, valve design, pressure and temperature classification, end connection details, seat materials, trim material and arrangement, dimensions and required clearance installation instructions.

1.04 QUALITY ASSURANCE:

A. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

B. Manufacturers Standardization Society of the Valve and Fittings industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Preparation For Transport: Prepare valves for shipping as follows:

1. Ensure valves are dry and internally protected against rust and corrosion.
2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
3. Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.

B. Storage: Use the following precautions during storage:

C. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.

D. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

E. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheel and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Available Manufacturers: Crane, Hammond, Grinnell, Milwaukee, Mueller Steam Specialty, Nibco, Stockham, Apollo, Keystone.

2.02 VALVE FEATURES, GENERAL:

A. Valve Design: Rising stem or rising outside screw and yoke stems.

1. Non-rising stem valves may be used where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

D. Operators: Provide the following special operator features:

1. Handwheel fastened to valve stem, for valves other than quarter turn.
2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 10 plug valves.
3. Chain-wheel operators, for valves 2-1/2-inch and larger, installed 96 inches or higher above finished floor elevation. Extend chains to an elevation of 6'-0" above finished floor elevation.
4. Gear drive operators, on quarter-turn valves 8-inch and larger.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

G. End Connections: As indicated in the valve specifications.

1. Threads: Comply with ANSI B1.20.1.
2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
3. Solder-Joint: Comply with ANSI B16.18.
   Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg F for ball valves.

2.03 GATE VALVES:

A. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 125, body and bonnet of ASTM B 62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 150 valves meeting the above where system pressure requires.

B. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Do not use solder end valves for hot water heating or steam piping applications.

C. Gate Valves, 2-1/2-Inch and Larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

2.04 BALL VALVES:

A. Ball Valves, 2 Inch and Smaller: MSS SP-110; Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; two-piece construction; with bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.

B. Ball Valves, 2-1/2” and larger: Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; 3-piece construction; with bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.

2.05 GLOBE VALVES:

A. Globe Valves, 2-Inch and Smaller: MSS SP-80; Class 125; body and screwed bonnet of ASTM B 62 cast bronze; with threaded or solder ends, brass or “Teflon” disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 150 valves meeting the above where system pressure requires.

B. Globe Valves, 2-1/2-Inch and Larger: MSS SP-85; Class 125 iron body and bolted bonnet conforming to ASTM A 126, Class B; with outside screw and yoke, bronze mounted, flanged ends, and "Teflon" impregnated packing, and two-piece backing gland assembly.

2.06 BUTTERFLY VALVES:

A. Butterfly Valves, 2-1/2-Inch and Larger: MSS SP-67; rated at 200 psi; cast-iron body conforming to ASTM A 126, Class B. Provide valves with field replaceable EPDM sleeve, aluminum bronze disc, stainless steel stem, and EPDM O-ring stem seals. Provide lever operators with locks and memory stops for sizes 2 through 6 inches and gear operators with position indicator for sizes 8 through 24 inches. Provide lug or wafer type as indicated. Lug-type valves on dead-end service or requiring additional body strength.

2.07 CHECK VALVES:

A. Swing Check Valves, 2-Inch and Smaller: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze or “Teflon” disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.

B. Swing Check Valves, 2-1/2-Inch and Larger: MSS SP-71; Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, and bronze disc or cast-iron disc with bronze disc ring; and flanged ends. Provide valves capable of being refitted while the valve remains in the line.

C. Wafer Check Valves: Class 250, cast-iron body; with replaceable bronze seat, and non-slam design lapped and balanced twin bronze flappers and stainless steel trim and torsion spring. Provide valves designed to open and close at approximately one foot differential pressure.

D. Lift Check Valves, 2-Inch and Smaller: Class 125; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Provide valves capable of being refitted and ground while the valve remains in the line.

PART 3 - EXECUTION

3.01 VALVE INSTALLATIONS:

A. General Application: Use gate, ball, and butterfly valves for shut-off duty; globe, ball, and butterfly for throttling duty. Ball valves shall not be used for steam service. Refer to piping system specification sections for specific valve applications and arrangements.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install three-valve bypass around each pressure-reducing valve using throttling-type valves.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.
2. Wafer Check Valves: Horizontal or vertical position, between flanges.
3. Lift Check Valve: With stem upright and plumb.

3.02 FIELD QUALITY CONTROL:

A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.03 ADJUSTING AND CLEANING:

A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

END OF SECTION

SECTION 20 01 20 - PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.02 DESCRIPTION OF WORK:

A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.

B. Types of piping specialties specified in this section include the following:

1. Pipe Escutcheons
2. Dielectric Unions
3. Sleeve Seals
4. Water Hammer Arresters
5. Pressure Regulating Valves
6. Relief Valves
7. Flexible Hose Kits

C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other specification sections.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, scale range, location, and features for each pipeline specialty.

B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 PIPE ESCUTCHEONS:

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings, and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe escutcheons which may be incorporated in the work include; but are not limited to, the following:

E. Manufacturers: Subject to compliance with requirements, provide pipe escutcheons of one of the following:

1. Chicago Specialty Mfg. Co.
2. Producers Specialty & Mfg. Corp.
3. Sanitary-Dash Mfg. Co.

2.02 DIELECTRIC UNIONS:

A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

B. Manufacturers: Subject to compliance with requirements, provide dielectric unions of one of the following:

1. B & K Industries, Inc.
2. Capital Mfg. Co.; Div. of Harsco Corp.
3. Eclipse, Inc.
4. Epco Sales, Inc.
5. Perfection Corp.
6. Rockford-Eclipse Div.

2.03 SLEEVE SEALS:

A. General: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

B. Manufacturer: Subject to compliance with requirements, provide mechanical sleeve seals of one of the following:

1. Link Seal as manufactured by Thunderline Corp.
2. MetraSeal as manufactured by Metraflex
3. Pipe Linx as manufactured by Calpico
4. PipeSeal as manufactured by Flexicraft Industries

2.04 WATER HAMMER ARRESTERS:

A. General: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.

B. Manufacturers: Subject to compliance with requirements, provide water hammer arresters of one of the following:

1. Amtrol, Inc.
2. Josam Mfg. Co.
3. Smith (Jay R.) Mfg. Co.
4. Tyler Pipe; Sub. of Tyler Corp.
5. Zurn Industries, Inc.; Hydromechanics Div.

2.05 WATER PRESSURE REGULATING VALVES:

A. Pressure Regulating Valves: Single seated, direct operated type; having bronze body with integral strainer, and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.

B. Manufacturers: Cash, Claval Co., Spence, Watts Regulator.

2.06 RELIEF VALVES:

A. Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.

B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 deg F, and pressure relief at 150 psi.

C. Manufacturers: Cash Watts, Zurn.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING SPECIALTIES:

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

C. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

D. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, at the top of all hot and cold domestic water risers, at the end of each water header in utility spaces, at the top of all branches to fixtures, at each solenoid valve or equipment with a quick closing valve.

3.02 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

A. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer.

1. Install sleeves accurately centered on pipe runs.
2. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run.
3. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation.
4. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves.
5. Extend floor sleeves 1/4" above level floor finish, and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
6. Install 20 gauge galvanized sheet-metal sleeves at wallboard, drywall, or plaster board interior partitions and ceilings other than suspended ceilings.
7. Install steel-pipe sleeves at all other penetrations and at exterior penetrations; both above and below grade.

B. Sleeve Seals: Install in accordance with the following:

1. The contractor shall determine the required inside diameter of each individual wall opening before ordering, fabricating, or installing.
2. The inside diameter of each wall opening shall be sized according to the manufacturer’s recommendations to fit the pipe and assure a water-tight fit.
3. If the pipe is a non-standard size, consult the manufacturer’s representative for engineering assistance and recommendation.
4. Install in accordance with the manufacturer’s recommendations.

END OF SECTION

SECTION 20 01 35 - METERS AND GAGES

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.02 DESCRIPTION OF WORK:

A. Extent of meters and gages required by this section is indicated on drawings and/or specified in Division 22 and 23 sections.

B. Types of meters and gages specified in this section include the following:

1. Temperature Gages and Fittings

a. Glass Thermometers
b. Direct Mount Dial Thermometers
c. Thermometer Wells
d. Temperature Gage Connector Plugs

2. Pressure Gages and Fittings

a. Pressure Gages
b. Pressure Gage Cocks
c. Pressure Gage Connector Plugs

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of meters and gages, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. UL Compliance: Comply with applicable UL standards pertaining to meters and gages.

2. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.

C. Certification: Provide meters and gages whose accuracies, under specified operating conditions, are certified by manufacturer.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gage. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gage schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gage.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gage. Include this data and product data in Maintenance Manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.01 GLASS THERMOMETERS:

A. General: Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Case: Die cast aluminum finished in baked epoxy enamel, glass front, spring secured, 9" long.

C. Adjustable Joint: Die cast aluminum, finished to match case, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.

D. Tube and Capillary: Blue spirit (organic liquid) filled, magnifying lens, 1% scale range accuracy, shock mounted.

E. Scale: Satin faced, non-reflective aluminum, permanently etched markings.

F. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.

G. Range: Conform to the following:

1. Hot Water: 30 - 240 °F with 2 °F scale divisions (0 - 160 °C) with 2 °C scale divisions).

2. Chilled Water: 0 - 100 °F with 1 °F scale divisions (0 - 100 °C) with 1 °C scale divisions).

H. Manufacturers: Subject to compliance with requirements, provide glass thermometers of one of the following:

1. Ashcroft
2. H.O. Trerice Company
3. Moeller Instrument Company, Inc.
4. Miljoco Corporation
5. Weiss Instruments, Inc.
6. Weksler

2.02 DIRECT MOUNT DIAL THERMOMETERS:

A. General: Provide direct mount dial thermometers of materials, capacities, and range indicated, designed and constructed for use in service indicated.

B. Type: Vapor tension, universal angle.

C. Case: Drawn steel or brass, glass lens, 4 1/2" diameter.

D. Adjustable Joint: Die cast aluminum, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.

E. Thermal Bulb: Copper with phosphor bronze bourdon pressure tube, one scale division accuracy.

F. Movement: Brass precision geared.

G. Scale: Progressive, satin faced, non-reflective aluminum, permanently etched markings.

H. Stem: Copper plated steel, or brass, for separable socket, length to suit installation.

I. Range: Conform to the following:

1. Hot Water: 40 - 240 °F (10 - 115 °C).
2. Chilled Water: 30 - 180 °F (0 - 80 °C)

J. Manufacturers: Subject to compliance with requirements, provide direct mount dial thermometers of one of the following.

1. Ashcroft
2. Ernst Gage Co.
3. H.O. Trerice Company
4. Marshalltown Instruments, Inc.
5. Moeller Instrument Company, Inc.
6. Miljoco Corporation
7. Weiss Instruments, Inc.
8. Weksler

2.03 THERMOMETERS WELLS:

A. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

B. Manufacturers: Same as thermometers.

2.04 TEMPERATURE GAGE CONNECTOR PLUGS:

A. General: Provide temperature gage connector plugs pressure rated for 500 psi and 200 F (93 C). Construct of brass and finish in nickel-plate, equip with 1/2" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

B. Manufacturer: Subject to compliance with requirements, provide temperature gage connector plugs of one of the following:

1. Peterson Equipment Co.
2. Sisco

2.05 PRESSURE GAGES:

A. General: Provide pressure gages of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.

C. Case: Drawn steel or brass, glass lens, 4 1/2" diameter.

D. Connector: Brass with 1/4" male NPT. Provide protective siphon when used for steam service.

E. Scale: White coated aluminum, with permanently etched markings.

F. Range: Conform to the following:

1. Vacuum: 30" Hg - 15 psi.
2. Water: 0 - 100 psi.
3. Low Pressure Steam: 0 – 30 psi
4. Medium Pressure Steam: 0 – 100 psi
5. High Pressure Steam: 0 - 200 psi.

G. Manufacturers: Subject to compliance with requirements, provide pressure gages of one of the following:

1. Ametek/U.S. Gauge.
2. Ashcroft
3. Ernst Gage Co.
4. H.O. Trerice Company
5. Marsh Instrument Co.; Unit of General Signal.
6. Moeller Instrument Company, Inc.
7. Miljoco Corporation
8. Weiss Instruments, Inc.
9. Weksler

2.06 PRESSURE GAGE COCKS:

A. General: Provide pressure gage cocks between pressure gages and gage tees on piping systems. Construct gage cock of brass with 1/4" female NPT on each end, and "T" handle brass plug.

B. Siphon: 1/4" straight coil constructed of brass tubing with 1/4" male NPT on each end.

C. Snubber: 1/4" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

D. Manufacturers: Same as for pressure gages.

2.07 PRESSURE GAGE CONNECTOR PLUGS:

A. General: Provide pressure gage connector plugs pressure rated for 500 psi and 200 F (93 °C). Construct of brass and finish in nickel-plated equip with 1/2" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion pressure gage. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

B. Manufacturer: Subject to compliance with requirements, provide pressure gage connector plugs of one of the following:

1. Peterson Equipment Co.
2. Sisco

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which meters and gages are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF TEMPERATURE GAGES:

A. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Locations: Install glass thermometers in the following locations, and elsewhere as indicated:

1. At inlet and outlet of each hydronic zone.
2. At inlet and outlet of each hydronic boiler and chiller.
3. At inlet and outlet of each hydronic coil in air handling units, and built-up central systems.
4. At inlet and outlet of each hydronic heat exchanger.
5. At inlet and outlet of each hydronic heat recovery unit.
6. At inlet and outlet of each thermal storage tank.

C. Install dial type thermometers at plumbing mixing valve.

D. Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Fill well with oil or graphite, secure cap.

E. Temperature Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.03 INSTALLATION OF PRESSURE GAGES:

A. General: Install pressure gages in piping tee with pressure gage cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At suction and discharge of each pump.
2. At discharge of each pressure reducing valve.
3. At water service outlet.
4. At inlet connection to each steam coil.
5. At inlet and outlet of water cooled condensers and refrigerant cooled chiller.

C. Pressure Gage Cocks: Install in piping tee with snubber. Install siphon for steam pressure gages.

D. Pressure Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.04 ADJUSTING AND CLEANING:

A. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gages and factory finished surfaces. Replace cracked or broken windows; repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 20 01 40 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.02 DESCRIPTION OF WORK:

A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 22 and 23 sections.

B. Types of supports and anchors specified in this section include the following:

1. Horizontal-Piping Hangers and Supports
2. Vertical-Piping Clamps
3. Hanger-Rod Attachments
4. Building Attachments
5. Saddles and Shields
6. Miscellaneous Materials
7. Anchors
8. Equipment Supports

C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in Division 22 and 23 sections.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

2. UL and FM Compliance: Provide products which are UL-listed and FM approved.

3. MSS Standard Compliance:

a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
b. Select and apply pipe hangers and supports, complying with MSS SP-69.
c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
d. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing Manufacturer's figure number, size, location, and features for each required pipe hanger and support.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

PART 2 - PRODUCTS

2.01 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

B. Adjustable Steel Clevis Hangers: MSS Type 1.

C. Pipe Hangers: MSS Type 5.

D. Adjustable Steel Band Hangers: MSS Type 7.

E. Extension Split Pipe Clamps: MSS Type 12.

F. U-Bolts: MSS Type 24.

G. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:

1. Plate: Unguided type.
2. Plate: Guided type.
3. Plate: Hold-down clamp type.

H. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.

I. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.

J. Single Pipe Rolls: MSS Type 41.

K. Adjustable Roller Hangers: MSS Type 43.

L. Pipe Roll Stands: MSS Type 44.

2.02 VERTICAL-PIPING CLAMPS:

A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper- plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

2.03 HANGER-ROD ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. Steel Turnbuckles: MSS Type 13.

C. Malleable Iron Sockets: MSS Type 16.

2.04 BUILDING ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

B. Concrete Inserts: MSS Type 18.

C. Side Beam or Channel Clamps: MSS Type 20.

D. Center Beam Clamps: MSS Type 21.

E. Top Beam Clamps: MSS Type 25.

F. Side Beam Clamps: MSS Type 27.

G. Steel Brackets: One of the following for indicated loading

1. Light Duty: MSS Type 31.

2. Medium Duty: MSS Type 32.

3. Heavy Duty: MSS Type 33.

H. Side Beam Brackets: MSS Type 34.

2.05 SADDLES AND SHIELDS:

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

D. Thermal Hanger Shields: Constructed of 360 insert of high density, 100 psi, water-proofed calcium silicate, encased in 360 sheet metal shield. Provide assembly of same thickness as adjoining insulation.

1. Manufacturers: Subject to compliance with requirements, provide thermal hanger shields of one of the following:

a. Elcen Metal Products Co.
b. Value Engineered Products, Inc.
c. Pipe Shields, Inc.

2.06 MANUFACTURERS OF HANGERS AND SUPPORTS:

A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:

1. Anvil International Inc. (formerly ITT Grinnel)
2. Carpenter and Patterson, Inc.
3. Cooper B-Line, Inc.
4. Elcen Metal Products Co.
5. Fee & Mason Mfg. Co.
6. Michigan Hanger
7. Persing & Co.
8. PHD Manufacturing
9. Powerstrut
10. Thomas & Betts Superstrut

2.07 MISCELLANEOUS MATERIALS:

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

E. Pipe Guides: Provide factory-fabricated guides, of cast semisteel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.08 ROOF EQUIPMENT SUPPORTS:

A. General: Construct roof equipment supports using minimum 18-gage galvanized steel with fully mitered and welded corners, 3" cant, internal bulkhead reinforcing, integral base plates, pressure treated wood nailer, and 18-gage galvanized steel counterflashing.

B. Configuration: Construct to sizes as indicated, compensate for slope in roof so top of support is dead level.

C. Manufacturers: Subject to compliance with requirements, provide roof equipment supports of one of the following:

1. Custom Curb, Inc.
2. Pate Co.
3. Thycurb Div.; Thybar Corp.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION:

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS:

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Existing concrete floor slabs for piping less than 1 ½" diameter: In concrete floor slabs where no inserts are in place, anchoring into the existing concrete shall be done with

expansion screw anchors and/or other means approved by the Engineer. At no time shall anchors be greater than 5/8" diameter.

D. Existing concrete floor slabs for piping 1 ½" and larger: In concrete construction where no inserts are in place, Unistrut or equal supports shall be fastened to the slab and have a continuous length between at least two joists, beams or columns. Unistrut shall be sized as recommended by the manufacturer for hanging indicated diameter piping. Anchoring into existing concrete shall be done with expansion screw anchors and/or other means approved by the Engineer.

E. Existing concrete beams and joists: In concrete construction where no inserts are in place, steel hanger rod clips shall be fastened to the sides of joists or beams as necessary for hanging indicated diameter piping. Anchoring shall be done with expansion screw anchors and/or other means as approved by the Engineer. Anchors shall be located at least 3" from the bottom of joists and 5" from the bottom of beams. Anchors for hangers shall not be inserted in the bottom of concrete beams or joists.

F. Support fire protection system piping independently of other piping.

G. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

H. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

K. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8" and over, install wood insulation saddles.

3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.05 INSTALLATION OF ANCHORS:

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.06 EQUIPMENT SUPPORTS:

A. Provide concrete housekeeping bases for all floor-mounted equipment. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation or as otherwise noted on the Drawings. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.07 ADJUSTING AND CLEANING:

A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 20 01 90 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.02 DESCRIPTION OF WORK:

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in Division 22 and 23 sections.

B. Types of identification devices specified in this section include the following:

1. Plastic Pipe Markers.
2. Valve Tags.
3. Valve Schedule Frames.
4. Plasticized Tags.

C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other sections.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, type written and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:

1. Allen-Bailey Tag & Label
2. Brady (W.H.) Co.; Signmark Div.
3. Brimar Industries, Inc.

4. Craftmark Identification Systems
5. Enterprise Marking Products, Inc.
6. Indianapolis Badge Co.
7. Industrial Safety & Supply
8. Seton Name Plate Corp.

2.02 MECHANICAL IDENTIFICATION MATERIALS:

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in Division 22 and 23 sections. Where more than single type is specified for application, selection is Installer's option; but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS:

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125° F (52° C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

2. Adhesive lap joint in pipe marker overlap.

3. Laminated or bonded application of pipe marker to pipe (or insulation).

4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2'' wide; full circle at both ends of pipe marker, tape lapped 3''.

D. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe (or insulation).

2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2''wide; full circle at both ends of pipe marker, tape lapped 3''.

3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

E. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Engineer in cases of variance with name as shown or specified.

2.04 PLASTIC TAPE:

A. General: Provide manufacturer's standard color-coded pressure- sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.05 VALVE TAGS:

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.

1. Provide 1-1/2" diameter tags, except as otherwise noted.

B. Plastic Valve Tags: Provide manufacturer's standard solid plastic valve tags with printed enamel lettering, with piping system abbreviation in approximately 3/16" high letters and sequenced valve numbers approximately 3/8" high, and with 5/32" hole for fastener.

1. Provide 1-1/8" sq. white tags with black lettering.

C. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.06 VALVE SCHEDULE FRAMES:

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.07 PLASTICIZED TAGS:

A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matte finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS:

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting, or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION:

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2" beyond ends of lettering.

2. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

1. Near each valve and control device.
2. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
3. Near major equipment items and other points of origination and termination.
4. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment, including mechanical rooms.

3.03 VALVE IDENTIFICATION:

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

3.04 VALVE SCHEDULE:

A. Mount valve tag chart on wall where noted on the drawings or as otherwise directed by the Owner.

3.05 ADJUSTING AND CLEANING:

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.06 MECHANICAL EQUIPMENT IDENTIFICATION:

A. Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Fans, blowers, primary balancing dampers and mixing boxes.
2. Packaged HVAC central station and zone type units.

END OF SECTION

SECTION 20 02 50 - MECHANICAL INSULATION

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 22, and 23 Specification Sections, apply to work of this Section.

B. This section applies to Division 22 and 23 Specification Sections.

1.01 DESCRIPTION OF WORK:

A. Furnish and install thermal insulation materials and accessories for mechanical systems as specified. Extent of mechanical insulation work required by this Section is indicated on drawings, schedules and by requirements of this Section. Lack of specific notation on the drawings however, does not relieve the Contractor of the responsibility for fully insulating all piping, ductwork, and equipment as herein specified.

B. Types of mechanical insulation specified in this Section include the following:

1. Piping System Insulation:

a. Fiberglass
b. Polyisocyanurate
c. Calcium Silicate
d. Cellular Glass
e. Flexible Unicellular

2. Ductwork System Insulation:

a. Fiberglass
b. Fire Rated Inorganic Duct Wrap

1.02 QUALITY ASSURANCE:

A. Reference Standards:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

a. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.

b. Exception: Mechanical insulation installed outdoors may have flame spread index of 75 and smoke developed index of 150.

2. 1988 National Commercial & Industrial Insulation Standards - Third Edition

3. Indiana Energy Conservation Code, 1992 Edition.

B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

1.03 SUBMITTALS:

A. Product Data:

1. Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation.

2. Submit schedule showing manufacturer's product number, k-value, thickness, density in Ibs./cu. ft., and furnished accessories for each mechanical system requiring insulation.

B. Where specified herein, submit manufacturer's sample of each piping, ductwork, and equipment insulation type required. Affix label to sample which completely describes product sample.

C. Submit maintenance manuals in accordance with Division 1specification requirements:

1. Maintenance manuals shall include the following:

a. Maintenance data
b. Replacement material lists for each type of mechanical insulation provided.

1.04 DELIVERY STORAGE AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation, or insulation that has been previously wetted and dried out; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Insulation Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following. The products of only one manufacturer shall be used for each particular insulation application.

1. armacell engineered foams (Armaflex)
2. CertainTeed Corp.
3. Dow Building Materials (Trymer 2000i)
4. Knauf Insulation
5. Johns-Manville
6. Manson Insulation Corporation
7. Owens-Corning Fiberglass Corp.
8. Pittsburgh Corning (Foamglas)
9. Rubatex International, LLC

B. Exterior Foil/Film Facing

1. Venture Tape Corporation

2.02 PIPING INSULATION MATERIALS:

A. Fiberglass Piping Insulation: ASTM C547, Class 3 for use to 850 degrees F.

1. Fibrous glass insulation, long glass fibers bonded in a thermosetting resin, 0.24 Btu•inch/sq. ft./°F/hour maximum “k” factor at 75°F differential, 3/4 pound per cubic foot minimum density, ASTM C547.

2. Factory-applied vapor barrier jacket consisting of high density, white kraft bonded to aluminum foil and reinforced with fiberglass yarn.

3. Insulation shall include pressure sensitive longitudinal laps and butt strips for sealing of all seams

B. Flexible Unicellular Piping Insulation: ASTM C534, Type I or Type II. (For use between -40 degrees F and 220 degrees F only.)

1. Elastomeric foam insulation, flexible, closed-cell construction, 0.27 Btu•inch/sq. ft./°F/hour maximum “k” factor at 75°F differential

2. 6 pound per cubic foot density, 0.20 perm maximum water vapor transmission, physically and chemically stable from -40°F to 220°F, ASTM C534, Type I - tubular or Type II - sheet.

C. Jackets for Piping Insulation: ASTM C 1136 for all piping except flexible unicellular and polyisocyanurate.

1. TYPE I - VAPOR BARRIER; (ASJ ALL SERVICE JACKET.)

D. Fitting Covers:

1. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations. (not required for flexible unicellular insulation.)

2. Under Premolded PVC fitting coverings, like Zeston 2000, wrap two separate layers of blanket insulation to provide same thickness and density as adjacent pipe covering.

a. Mitered segments of pipe insulation are also acceptable for fittings under PVC fitting covers when installing fiberglass insulation.

b. Install mitered or premolded insulation when installing calcium silicate or cellular foam glass insulation. Wrap calcium silicate mitered fittings with 8 oz, glass cloth.

c. General Note: If a Premolded PVC fitting is found crushed or indented after installation and the filler material, upon inspection, is found to be out of specification, the Insulation Contractor shall, at no charge to the Owner, remove any other Zeston fitting covers, directed by the Engineer on any other specified pipe systems for visual inspection, repair and replace all out of specification fitting fillers and then re-install all fitting covers.

3. Systems using Polyisocyanurate insulation shall use preformed insulation of the same manufacturer.

E. Staples and Cement:

1. As recommended by insulation manufacturer for applications indicated.

F. Adhesives Sealers and Protective Finishes:

1. As recommended by insulation manufacturer for applications indicated.

2.03 DUCTWORK INSULATION MATERIALS:

A. Rigid Fiberglass Ductwork Insulation: ASTM C612, Class 1, Foil Scrim Kraft (FSK) Facing.

1. Rigid fiberglass ductwork insulation, 0.23 Btu•inch/sq. ft./°F/hour maximum “k” factor at 75°F differential

2. 3 pound per cubic foot minimum density, ASTM C612, Class 1, with barrier jacket constructed of FSK laminated to fire resistive kraft suitable for use to 450 degrees F.

B. Semi-Rigid Fiberglass Duct Insulation for Round and Flat Oval Ductwork: ASTM C 612, Type I, FSK facing.

1. Semi-Rigid fiberglass ductwork insulation, 0.23 Btu•inch/sq. ft./°F/hour maximum “k” factor at 75°F differential

2. 3 pound per cubic foot minimum density, ASTM C612, Class 1, with barrier jacket constructed of FSK laminated to fire resistive kraft suitable for use to 450 degrees F.

C. Flexible Fiberglass Ductwork Insulation: ASTM C553, Type I, Class B-3, FSK facing.

1. Flexible fiberglass blanket insulation, 0.27 Btu•inch/sq. ft./°F/hour maximum “k” factor at 75°F differential

2. 1 pound per cubic foot minimum density, ASTM C553, Type I, with 0.002” aluminum reinforced foil-scrim-kraft (FSK) jacket suitable for use to 250 degrees F.

D. Jackets for Ductwork Insulation: ASTM C 1136 for all ductwork.

1. TYPE I - VAPOR BARRIER, FOIL SCRIM KRAFT, (FSK)

E. Ductwork Insulation Accessories:

1. Provide pins, washers, tape, and similar accessories as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 PLUMBING PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.

B. Hot and Cold Piping:

1. Application Requirements: Insulate the following hot and cold plumbing piping systems:

   a. Potable cold water piping
   b. Potable hot water piping
   c. Potable hot water recirculating piping

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

   a. Fiberglass:

      (1) Cold water-1" thick.
      (2) Hot water- 1" thick for pipe sizes through 2"- 1-1/2" thick for pipe sizes 2-1/2" and larger.

   b. Flexible Unicellular:

      (1) Tubing type for cold water and hot water – 1/2" thick for pipe sizes through 2".
      (2) Sheet type for storm roof drain bowls and sump pans -1/2" thick.

3.03 DUCTWORK SYSTEM INSULATION:

A. Insulation Omitted: Do not insulate indoor fibrous glass ductwork, or indoor lined ductwork except as otherwise noted below.

B. The specifications below apply when ductwork is round, oval or unlined rectangular. See ductwork Specification Sections for ductwork to be lined.

C. Refer to the drawings for locations where Fire Rated Inorganic Duct Wrap is to be used in lieu of specified insulation for the express purpose of providing a fire resistive membrane around a duct.

D. Cold Ductwork:

1. Application Requirements: Insulate the following cold ductwork:

   a. Outdoor air plenum and intake ductwork (including fans, dampers, etc.) between the plenum and inlet of the air warming or cooling device.

   b. Relief air plenum and relief air ductwork between the plenum and the relief air motorized shut-off/back-draft damper in each duct connecting to the relief plenum.

2. Insulate the ductwork system specified above with the following type and thickness of insulation:

   a. Rigid Fiberglass: 2" thick.

   b. Semi-Rigid Fiberglass: 2" thick, for round and flat oval ductwork.

E. Hot Ductwork (Above Ambient Temperature):

1. Application Requirements: Insulate the following hot ductwork:

   a. Range and hood exhaust ductwork. (This duct must always be wrapped externally. It cannot be lined.)

2. Insulate each ductwork system specified above with the following type and thickness of insulation:

a. Rigid Fiberglass: 2" thick

F. HVAC Ductwork (Supply and Return):

1. Application Requirements: Insulate the following conditioned air ductwork:

a. Supply and return ductwork between fan discharge or HVAC unit discharge and room terminal outlets. This work includes unlined plenum boxes at all slot diffusers.

b. Omit insulation on return air ductwork located in return air ceiling plenums or where exposed in a conditioned area.

2. Insulate each ductwork system specified above with the following type and thickness of insulation:

a. Rigid Fiberglass: 2" thick in Equipment Rooms and where ductwork is exposed.

b. Flexible Fiberglass: 2" thick, application limited to concealed locations

c. Semi-Rigid Fiberglass: 2" thick, for round and flat oval ductwork in Equipment Rooms and where ductwork is exposed.

3.04 INSTALLATION OF PIPING INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe system subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. On heat traced lines, insulation shall be oversized to accommodate the heat trace tubes or cables.

D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

E. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

F. Maintain integrity of vapor barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Repair all punctures with ASJ tape designed for duty.

G. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific type is indicated.

H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

J. Insulation Shields and Protection Saddles: Provide insulation shields and 20# density fiberglass blocking at each hanger site in accordance with detail on drawings, providing shield gauges and blocking thicknesses shown. Cut and shape insulation to fit around protection saddles on steam and hot water piping. Saddles to be furnished and installed by piping trade.

3.05 INSTALLATION OF DUCTWORK INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage. Repair all puncture sites with FSK tape designed for the duty.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or linings have been installed.

G. Fire Rated Inorganic Duct Wrap: shall be installed in strict compliance with the manufacturer's installation instructions to meet the UL classification indicated. Wrap shall be installed in single or multiple layers to provide hourly rating noted on the drawings.

3.06 EXISTING INSULATION REPAIR:

A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

3.07 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damaged and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and **Division 20** Specification Sections, apply to work of this Section.

1.02 SUMMARY:

A. All pipe, fittings, and pipe joining material used for potable water systems shall be lead free in accordance with state and federal regulations.

B. This Section specifies the water distribution piping system, including potable cold, hot, and recirculated hot water piping, fittings, and specialties within the building.

1.03 DEFINITIONS:

A. Water Distribution Piping: A pipe within the building, or on the premises, which conveys water from the water service pipe, or meter, to the points of usage.

B. Water Service Piping: The pipe from the water main, or other source of potable water supply, to the water distributing system of the building served.

C. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

1.04 SUBMITTALS:

A. Product data for each piping specialty and valve specified.

1. Submittals and shop drawings shall include the following data:

a. Manufacturer’s technical data including valve performance and capacity.
b. Accessories furnished.
c. Manufacturer’s recommended installation methods.

B. Maintenance data for each piping specialty and valve specified for inclusion in Operation and Maintenance Manual.

1. Maintenance manuals shall include the following:

a. Parts lists for each type and size of thermostatic valve unit
b. Published installation instructions.
c. Troubleshooting maintenance guide for each type of thermostatic valve unit.

C. Welder’s certificates certifying that welders comply with requirements specified in Quality Assurance below.

D. Certification of Compliance with ASME and UL fabrication requirements specified below.

E. Test reports specified in Part 3 of this Section.

1.05 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with the provisions of the following:

1. ASME B 31.9 “Building Services Piping” for, materials, products and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

2. ASME Boiler and Pressure Vessel Code, Section IX, “Welding and Brazing Qualification” for Qualifications for Welding Processes and Operators

3. Indiana Plumbing Code.

B. Reference Standards:

1. ASSE Standard 1016: Performance Requirements for Individual Thermostatic, Pressure Balancing and Combination Control Valves for Bathing Facilities.

2. ASSE Standard 1017: Performance Requirements for Temperature Actuated Mixing Valves for Primary Domestic Use

3. ANSI Standard Z358.1-1998: Emergency Eyewash and Shower Equipment

4. Americans with Disabilities Act (ADA) Accessibility Guidelines

C. Each thermostatic valve unit shall be completely factory assembled, piped, tested, and adjusted with water flow, prior to shipment.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Store pipe in a manner to prevent sagging and bending.

B. Store CPVC, PVC, or PB pipe and fittings protected from direct sunlight.

1.07 SEQUENCING AND SCHEDULING:

A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad.

B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

1.08 EXTRA STOCK:

A. Maintenance Stock: Furnish one valve key for each key operated hydrant, bibb, or faucet installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

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

B. Basket Strainers:
1. Josam Mfg. Co.
2. Metraflex Co.
3. Mueller
4. Spirax Sarco
5. Smith (Jay R.) Mfg. Co.

C. Balance Cocks:

1. American Air Filter Co.
2. Bell & Gossett ITT; Fluid Handling Div.
3. Hammond Valve Corp.
4. Milwaukee Valve Co., Inc.
5. Spirax Sarco
6. Taco, Inc.

D. Bibbs and Faucets:

1. Chicago Faucet Co.
2. Hammond Valve Corp.
3. Lee Brothers: Div. Phelps Dodge Brass Co.
4. Mansfield Plumbing Products
5. Nibco Inc.
6. Watts Regulator Co.

E. Hydrants:

1. Josam Mfg. Co.
2. Jay R. Smith Mfg. Co.
3. Wade/Tyler Pipe; Sub. of Tyler Corp.
4. Watts Drainage Products
5. Woodford Mfg. Co.
6. Zurn Industries Inc., Hydromechanics Div.

F. Backflow Preventers:

1. Febco Sales, Inc.: Subs. of Charles M. Bailey Co., Inc.
2. Hersey Products, Inc.
3. ITT Lawler; Fluid Handling Div.
4. Watts Regulator Co.
5. Zum Industries, Inc.; Wilkins-Regulator Div.

G. Vacuum Breakers

1. Watts Regulator Co.
2. Febco Sales, Inc.; Subs. of Charles M. Bailey Co., Inc.
3. Zurn Industries, Inc.; Wilkins-Regulator Div.

H. Pressure Regulating Valves:

1. Cash (A. W.) Valve Mfg. Corp.
2. Cla-Val Co.

3. Spence Engineering Co., Inc.
4. Watts Regulator Co.

I. Thermostatic Mixing Valves

1. Lawler
2. Bradley
3. Powers Hydroguard
4. Sloan
5. Symmons

J. Automatic Flow Control Valves

1. Griswold Controls

K. Relief Valves:

1. Cash (A. W.) Valve Mfg. Corp.
2. Conbraco Industries, Inc.
3. Watts Regulator Co.
4. Zurn Industries, Inc.; Wilkins-Regulator Div.

L. Water Hammer Arresters:

1. Amtrol, Inc.
2. Josam Manufacturing Co.
3. Jay R. Smith Mfg. Co.
4. Wade/Tyler Pipe; Sub. of Tyler Corp.
5. Watts Drainage Products
6. Zurn Industries, Inc.; Hydromechanics Div.
7. (Sioux Chief Manufacturing Co., Inc.)
8. (Precision Plumbing Products, Inc.)

M. Dielectric Unions:

1. Perfection Corp.
2. Watts Regulator Co.

N. Y-Pattern Strainers:

1. Armstrong Machine Works
2. Hofhman Specialty ITT: Fluid Handling Div.
3. Metraflex Co.
4. Mueller
5. Spirax Sarco
6. Watts Regulator Co.

O. Press Fittings

1. ProPress by Ridgid/Viega

2.02 PIPE AND TUBE MATERIALS:

A. General: Refer to Part 3, Article Applications, for identification of systems where the below materials are used.

B. Drawn tempered copper tubing: ASTM B88, Type L

C. Annealed tempered copper tubing: ASTM B88, Type K

D. Steel pipe: ASTM A12O, schedule 40, seamless, galvanized, cut groove ends.

E. Ductile iron pipe: ANSI A21.51 ductile iron pipe, with ANSI A21.4 cement mortar lining.

F. CPVC Plastic Pipe: ASTM D2846, Chlorinated Polyvinyl Chloride (CPVC) schedule 40, pipe and socket-type fittings with compatible solvent cement.

G. PVC Plastic Pipe: AWWA C900, Class 100 Polyvinyl Chloride (PVC) water pipe, with socket-type fittings and compatible solvent cement.

H. PB Plastic Pipe: ASTM D3309, Polybutylene (PB), SDR11, with socket-type fittings for heat-fusion joints

2.03 FITTINGS:

A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

B. Galvanized Cast-iron Threaded Fittings: ANSI B16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

C. Ductile-iron Gasketed Fittings: AWWA C110, Schedule 150, with cement mortar lining and AWWA C111 rubber gaskets.

D. Press fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or B16.22. O-rings for the copper press fittings shall be EPDM.

E. Grooved Mechanical Fittings: ASTM A 106, Grade B galvanized steel fittings with grooves or shoulders designed to accept grooved end couplings.

F. Grooved Mechanical Couplings: Consist of non-galvanized ductile or malleable iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

G. CPVC Plastic Fittings: ASTM D 2846, Chlorinated Polyvinyl Chloride (CPVC) socket-type fittings and solvent for solvent cemented joints.

H. Cast-iron Threaded Flanges: ANSI B16.1, Class 125; raised ground face, bolt holes spot faced.

I. Cast Bronze Flanges: ANSI B16.24, Class 150; raised ground face, bolt holes spot faced.

2.04 UNIONS AND CONNECTORS:

A. Unions: ANSI B16.39, malleable iron, Class 150, hexagonal stock, with ball- and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends. Threads shall conform to ANSI B1.20.1.

B. Dielectric Unions: Threaded or soldered end connections as required to suit application; constructed to isolate copper from galvanized pipe, prevent galvanic action, and prevent corrosion.

C. Flexible Connectors: Stainless steel bellows with woven flexible bronze wire reinforcing protective jacket; minimum 150 psig working pressure, maximum 250° F operating temperature. Connectors shall have flanged or threaded end connections to match equipment connected; and shall be capable of 3/4 inch misalignment.

2.05 JOINING MATERIALS:

A. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony.

1. J.W. Harris "Stay-safe 50" or equal 94.5% Tin, 0.5% Silver, 3% Antimony, 1.5% Zinc and 0.5%Copper.

B. Brazing Filler Metals: AWS A5.8, BCup-4 6% silver for joints below ground.

C. Copper Pipe 2 1/2” and larger; (TIG) Gas Tungsten arc welding.

D. Gasket Material: Thickness, material, and type suitable for fluid to be handled, and design temperatures and pressures.

2.06 GENERAL DUTY VALVES:

A. Valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division-15 Section “Valves”. Special duty valves are specified below by their generic name; refer to Part 3 Article "VALVE APPLICATION" for specific uses and applications for each valve specified.

2.07 SPECIAL DUTY VALVES:

A. Balance Cocks: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern, with threaded or solder end connections conforming to ANSI B1.20.1.

2.08 AUTOMATIC WATER FLOW CONTROL VALVES:

A. General: Provide factory calibrated, direct acting, automatic pressure compensating type flow control valves. Each valve shall limit flow rates to within ±5 accuracy, regardless of system pressure fluctuations.

B. Valve control mechanism shall consist of a tamperproof, stainless steel cartridge assembly with open chambers and unobstructed flow passages. Cartridge assembly shall include a self-cleaning, spring loaded moving cup guided at two separate points and shall utilize the full available differential pressure to actuate without hysterisis or binding.

C. Each valve shall be equipped with an upstream and downstream P/T fitting. Four differential pressure ranges shall be available with the minimum range requiring less than 2 psig.

D. Each valve to be provided with a metal tag, chain and stamped for system identification. Pressure taps and quick disconnect valves shall be provided with ferrous bodies.

E. All system flow control valves shall be of one manufacturer.

F. At the Contractor's option, flow control valves 1" and smaller with flow rates of 10 gpm and under, may be equipped with a combination upstream ball valve, Y-strainer with 20 mesh screen, an upstream P/T fitting, the flow control cartridge, a downstream P/T fitting, and an outlet union. Valve shall be like Griswold “Isolator Y”.

G. Flow control valves shall be warranted by the manufacturer for five (5) years from the date of substantial completion.

2.09 THERMOSTATIC MIXING VALVE:

A. GENERAL:

1. Thermostatic mixing valve requirements shall include a cast bronze body, thermostatic element of bellows or bi-metallic design of non-corrosive components, union inlets, combination strainer check-stops, tamper resistant adjustment, failure of thermostatic element shall shut off flow.

B. HIGH/LOW MANIFOLD SYSTEMS

1. Large and small mixing valves shall be selected to meet maximum and minimum demand for hot water requirements, with components as required in general thermostatic mixing valve requirements. A pressure regulating valve shall adjust to varying flow requirements, opening to allow flow from the larger valve as demand increases. System shall be furnished complete with shutoffs on each mixing valve, pressure gauges and outlet temperature dial.

C. SHOWER CONTROL MIXING VALVES

1. Concealed mixing valve for use on shower applications with components as required in general thermostatic mixing valve requirements, cast brass body, die-cast chrome plated lever handle control, stainless steel face plate.

2.10 PIPING SPECIALTIES:

A. Water Hammer Arresters: Water hammer arresters shall be sized, tested and certified in accordance with PDI Standard WH-201, A.S.S.E.-1010 and A.N.S.I.-A112.26.1.

1. Spun closed, one-piece, seamless type 'L' copper tube and factory charged, with acetal piston, three EPDM O-rings, pressure-lubricated with Dow Coming III silicone compound, FDA approved. Unit shall be pressure rated for 250 psi, designed to keep waterline at 150 psi working pressure during pressure surges following quick valve closure. Working temperature from 33° F to 250° F

2. Constructed of all stainless steel and with internal heavy duty balanced expansion bellows, pre-charged suitable for operation in temperature range of minus 100 to 300 degrees F and maximum 250 psig working pressure.

B. Basket Strainers: Cast-iron body, 125 psi flanges, bolted type or yoke type cover; with removable non-corrosive perforated strainer basket having 1/8 inch perforations and lift-out handle.

2.11 HOSE BIBBS AND HYDRANTS:

A. Hose Bibbs: Bronze body, renewable composition disc, tee handle, 3/4 inch NPT inlet, 3/4 inch hose outlet.

B. Sill Faucets: Bronze body, with renewable composition disc, wheel handle, 3/4 inch NPT inlet, 3/4 inch hose outlet.

C. Recessed Non-freeze Wall Hydrants (WH-1): Cast-bronze box, nickel bronze face, tee handle key, vacuum breaker, hinged locking cover, 3/4 inch inlet, and hose outlet. Bronze casing shall be length to suit wall thickness. J.R.Smith model 5509 QT.

D. Projecting Non-Freeze Wall Hydrants (WH-1): Cast-bronze, with nickel bronze face, tee handle key, vacuum breaker, 3/4 inch inlet, and hose outlet. Bronze casing shall be length to suit wall thickness. J.R.Smith model 5609 QT.

2.12 BACKFLOW PREVENTERS:

A. Backflow Preventers: Reduced pressure zone principle assembly consisting of shutoff valves on inlet and outlet, and strainer on inlet. Assemblies shall include test cocks, and pressure differential relief valve located between 2 positive seating check valves, and comply with requirements of ASSE Standard 1013. Unit must be listed by name and model number on the State Department of Health approved list of RPZ type valves.

B. Pressure Type Vacuum Breaker: Watts No. 800 QT pressure type vacuum breaker certified under FCCCHR of USC Section 10, ASSE Std. 1020. Unit must be listed on the State Department of Health approved list of "Pressure Type Vacuum Breakers.

2.13 REGULATING AND RELIEF VALVES:

A. Pressure Regulating Valves:

1. Single seated, direct operated type: having bronze body with integral strainer, and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated. Cla-Val 990 series.

2. Hydraulically pilot operated single diaphragm actuated type: having ductile iron body and cover, FDA approved diaphragm resilient synthetic rubber disc; restriction fitting, pressure reducing control, strainers, isolation valves. Select proper size for maximum flow rate and inlet and outlet pressures indicated. Cla-Val 90-01 series.

B. Relief Valves: Provide proper size relief valve, in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.

C. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 °F, and pressure relief at 150 psig.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.

B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.

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

3.02 PIPE APPLICATIONS:

A. Install Type L, drawn copper tubing with wrought copper fittings and solder joints for 4 inch and smaller above ground, within building. At the contractor's option, install Type L, drawn copper tubing with wrought copper press fittings in accordance with the manufacturer's recommendations for 2 inch and smaller above ground within building.

B. Install Type K, annealed temper copper tubing for 2 inch and smaller with minimum number of joints, below ground and within slabs.

C. Install steel pipe with threaded joints and fittings for all sizes larger than 4" above ground, within building. Install cement-lined ductile-iron pipe with rubber gasketed joints below ground, inside and outside the building.

D. Install steel pipe with cut-grooved ends, grooved mechanical fittings, and mechanical couplings above and below ground, inside the building.

E. Install CPVC plastic pipe with solvent cemented joints below ground, within the building.

F. Install PB plastic pipe with heat-fusion joints below ground, within the building.

3.03 PIPING INSTALLATION:

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.

B. Use fittings for all changes in direction and all branch connections.

C. Branch connections shall be made from the side or bottom of the main to facilitate drainage.

D. Install exposed piping, at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

E. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

F. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

G. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building.

H. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

I. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

J. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4 inch ball valve, and short 3/4 inch threaded nipple and cap.

K. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel: pipe sleeves 6 inch and larger shall be sheet metal.

L. Fire Barrier Penetrations: Where pipes pass through time rated fire restive construction including fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division-7 for special sealers and materials.

M. Install piping level with no pitch.

3.04 HANGERS AND SUPPORTS:

A. General: Hangers, supports, and anchors devices are specified in Section 20 01 40 "SUPPORTS AND ANCHORS". Conform to the table below for maximum spacing of supports:

B. Install the following pipe attachments

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.

2. Adjustable roller hangers and spring hangers for individual horizontal runs 20 feet and longer.

3. Pipe roller, complete-MSS Type 44 for multiple horizontal runs, 20 feet or longer, support on a trapeze.

C. Install hangers with the following minimum rod sizes and maximum spacing:

Nom. Pipe Size	Max. Span-Ft	Min. Rod Size-Inches

1 and smaller	7	3/8
1-1/4 and 1-1/2	9	3/8
2	10	3/8
3	12	1/2
3-1/2	13	1/2
4	14	5/8
5	16	5/8
6	17	3/4
8	19	7/8
10	22	7/8
12	23	7/8

Support vertical runs at each floor.

3.05 PIPE AND TUBE JOINT CONSTRUCTION:

A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."

1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering.

2. Heat joints to proper and uniform temperature.

B. Threaded Joints: Conform to ANSI B1.20. 1, tapered pipe threads for field cut threads. Join pipe fittings and valves as follows:

1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.

2. Align threads at point of assembly.

3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

4. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

5. Damaged Threads: Do not use pipe with threads which an corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

C. Flanged Joints: Align flanged surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible.

1. Use suitable lubricants on bolt threads.

2. Tighten bolts gradually and uniformly using torque wrench.

D. CPVC Pipe fittings: Conform to ASTM D2846.

E. PB heat-fusion and compression joints: Conform to ASTM D3309.

3.06 VALVE APPLICATIONS:

A. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:

B. Shut-off duty: Use gate, ball, and butterfly valves.

C. Throttling duty: Use ball, and butterfly valves.

3.07 INSTALLATION OF VALVES:

A. Sectional Valves: Install sectional valves on each branch and riser close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2 inch and smaller, use gate or ball valves; for sectional valves 2-1/2 inch and larger, use gate or butterfly valves.

B. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2 inch and smaller, use gate or ball valves; for shutoff valves 2-1/2 inch and larger, use gate or butterfly valves.

C. Drain Valves: Install drain valves on each plumbing equipment item, located to completely drain equipment for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to completely drain distribution piping system. For drain valves 2 inch and smaller, use gate or ball valves; for drain valves 2-1/2 inch and larger, use gate or butterfly valves.

D. Check Valves: Install swing check valves on discharge side of each pump, and elsewhere as indicated.

E. Balance Cocks: Install in each hot water recirculating loop, the discharge side of each pump, and elsewhere as indicated.

F. Automatic Flow Control Valves: Install in each hot water recirculating loop, the discharge side of each pump and elsewhere as indicated.

G. Hose Bibbs, Sill Faucets: Install where indicated, with vacuum breaker.

3.08 INSTALLATION OF PIPING SPECIALTIES:

A. Install backflow preventers at each connection to mechanical equipment and systems, and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Pipe relief outlet without valves, to nearest floor drain. RPZ backflow preventers are required only on specific services, **per State of Indiana Administrative Rules, Section 327 IAC 8-10-4, "Cross Connection Hazards".**

B. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gage on valve outlet. Installation shall be in accordance with manufacturer's piping diagrams.

C. Install full size piping from discharge of pressure relief valves to nearest floor drain or mop basin.

D. Size and Locate Water Hammer Arresters in accordance with the following schedule, and located within an effective range of the quick-closing valve as per the requirements of Standard PDI-WH2O1 current edition, whether shown or not shown on the drawings.

WATER HAMMER ARRESTER SCHEDULE

MARK	I.P.S.	F.U. RATING	J.R. SMITH NO.	WADE NO.	ZURN NO.
'A'	3/4"	1-11	5005	W-5	100
'B'	1”	12-32	5010	W-10	200
'C'	1”	33-60	5020	W20	300
'D'	1”	61-113	5030	W-50	400
'E'	1”	114-154	5040	W-75	500
'F'	1”	155-330	5050	W-100	600

All water hammer arresters shall be P.D.I. certified.

3.09 INSTALLATION OF THERMOSTATIC MIXING VALVES:

A. Install thermostatic mixing valves and trim as recommended by manufacturer. Provide valve, strainer, and union on each inlet, check valve, and shut-off valve on outlet.

B. On installations which include a domestic hot water return system, piping arrangement shall be installed per the manufacturer’s requirements.

C. Following completion of installation, plumbing contractor shall verify each unit for proper operation and shall adjust each unit for correct discharge temperature. On High/Low thermostatic valve setup, the contractor shall open enough fixtures to establish a high flow condition during temperature adjustment. Contractor shall maintain flow for a minimum of 10 minutes to ensure adequate temperature settings.

3.10 EQUIPMENT CONNECTIONS:

A. Supplies and Trim: All supplies, hardware, trim, traps, etc. to fixtures and equipment shall be chrome plated brass if exposed.

B. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.

C. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated. Provide shutoff valve and union for each connection. Provide drain valve on drain connection. For connections 2-1/2" and larger, use flanges instead of unions.

3.11 FIELD QUALITY CONTROL:

A. Inspections: Inspect water distribution piping as follows:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the process of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

3. Rough-in Inspection: Arrange for inspection of the piping system before being concealed or closed-in after system is roughed-in, and prior to setting fixtures.

4. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

5. Reinspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.

6. Reports: Prepare inspection reports, signed by the plumbing official.

B. Test water distribution piping as follows:

1. Test for leaks and defects all new water distribution piping systems and parts of existing systems which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.

3. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.

4. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

5. Prepare reports for all tests and required corrective action.

3.12 ADJUSTING AND CLEANING:

A. Clean and Disinfect water distribution piping as follows:

B. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.

C. Hot water piping shall be sterilized with cold water, not heated.

D. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA D105. or as described below:

1. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.

2. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.

3. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.

4. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming for the system.

5. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

E. Prepare reports for all purging and disinfecting activities.

F. The Contractor shall be solely responsible for the final delivery of potable water approved by the Indiana State Department of Health.

3.13 COMMISSIONING:

A. Fill the system.

B. Check compression tanks to determine that they are not air bound and that the system is completely full of water.

C. Before operating the system perform these steps:

D. Open valves to full open position. Close drain valves, hydrants, and sill cocks.

E. Remove and clean strainers.

F. Check pump for proper direction of rotation. Correct improper wiring.

G. Lubricate pump motors and bearings.

END OF SECTION

SECTION 22 11 2 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.02 WORK DESCRIPTION:

A. Scope of Work:

1. Furnish pumping products and accessories for building potable water systems of configuration or type as shown and/or scheduled on the drawings.
2. The Contractor shall furnish all the labor, materials, equipment, services, and drayage, and perform all the operations in connection with the installation of the products specified herein.
3. Electrical service to units shall be provided as specified under **Division 26** sections.

B. Types of pumps specified in this section include the following:

1. Compact bronze cartridge circulators
2. In-line bronze-fitted circulators

1.03 SUBMITTALS:

A. Submit descriptive product literature and shop drawings in accordance with Division 1.

1. Submittals and shop drawings shall include the following data:

a. Manufacturer’s technical data including certified performance curves and rated capacity. Operating points shall be indicated on the performance curves.
b. Wiring schematics including ladder type diagrams which differentiate between factory installed and field installed portions.
c. Dimensional data including weights and required clearances.
d. Accessories furnished.
e. Manufacturer’s installation requirements.

B. Submit maintenance manuals in accordance with Division 1

1. Maintenance manuals shall include the following:

a. Parts lists for each type and size of pump or system
b. Published installation instructions.
c. Troubleshooting maintenance guide for each type of pump or system.

1.04 QUALITY ASSURANCE:

A. Reference Standards:

1. UL Standard 778: “Motor Operated Water Pumps”. All plumbing pumps shall be listed and labeled by UL or another nationally recognized testing laboratory (NRTL) to UL Standard 778.
2. Hydraulic Institute: “Centrifugal Pumps - Instructions for Installation, Operation, and Maintenance.”
3. ASME Section VIII: Fabricate and stamp expansion tanks to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

B. Provide electric motors and components which are NEMA listed and labeled.

C. Testing:

1. All plumbing pumps shall be factory assembled, wired, and tested, prior to shipment.
2. Domestic booster pump systems shall be tested at 0%, 25%, 50%, 75%, and 100% of full load capacity at scheduled suction and discharge pressure conditions.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. All pumps shall be stored in a dry location.

1. For extended storage times (greater than 1 week), dry internal parts with hot air or a vacuum producing device. After drying, coat internal parts with light oil, kerosene, or antifreeze. Dismantle bearings and couplings, dry and coat with an acid-free, heavy oil, and tag and store.

B. Retain shipping flange protective covers and protective coatings during storage.

C. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

D. Comply with manufacturer’s rigging instructions for handling.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Provide factory assembled and tested, single stage, centrifugal pumps which comply with UL 778. Each pump shall have all bronze construction, suitable for potable water service, and components in contact with water shall be made of corrosion resistant materials.

B. Each pump shall have sufficient capacity to circulate the scheduled GPM against the scheduled dynamic head (feet) with the horsepower and speed as scheduled and/or as denoted on the drawings.

C. Pump characteristics shall be such that the head of the pump, under varying conditions, shall not exceed the rated horsepower of the drive motor.

D. Motors shall be of electrical characteristics as scheduled, denoted, and/or as indicated and shall include built-in thermal overload protection appropriate for motor size and duty.

E. Each pump shall have flanged connections and shall be provided with matching threaded companion flanges. Pumps shall be shipped with protective flange covers.

2.02 COMPACT BRONZE CARTRIDGE CIRCULATORS:

A. Compact pump circulators shall be of horizontal, in-line, single speed design and shall be rated for 125 psig minimum working pressure at a minimum continuous water temperature of 225°F. Impellers shall be nylon, bronze, stainless steel, or another corrosion resistant material. A replaceable cartridge containing all moving components shall allow servicing the pump without replacement of the entire unit.

B. Acceptable manufacturers:

1. Armstrong Pumps, Inc. - “Sure Start”
2. Grundfos Pumps Corp. - “UP” Series
3. ITT Bell & Gossett - “Little Red”
4. Taco, Inc. - “00” Series

2.03 IN-LINE BRONZE-FITTED CIRCULATORS:

A. In-line circulators shall be of horizontal, in-line, design with a radially split, all-bronze casing and shall be rated for 125 psig minimum working pressure at a minimum continuous water temperature of 200°F. Impellers shall be one piece brass or bronze, dynamically balanced, with stainless steel shaft and spring coupling. Bearings shall be oil lubricated, bronze sleeve type and mechanical seals shall be a two piece carbon/ceramic assembly. Motor shall be open, drip-proof, resilient mounted, with oil lubricated sleeve bearings for quiet operation.

B. Acceptable manufacturers:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc. - 1000 Series
3. ITT Bell & Gossett - Series 100
4. Taco, Inc. - “Red Baron”

2.04 ACCESSORIES:

A. Provide a temperature aquastat to allow cycling of each domestic water circulator. Aquastats shall snap directly onto a ¾” pipe and shall cycle to maintain a temperature between 95°F and 110°F.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Comply with the manufacturer’s instructions for installation.

B. Install pumps at locations indicated on the drawings, providing access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.

C. Suspend in-line pumps with all-thread hanger rod and vibration isolation hangers of sufficient size to support the weight of the pump independent from the piping.

3.02 CONNECTIONS:

A. All piping shall be brought to the pump connections in such a manner so as to prevent the possibility of any loads or stresses being applied to the pump connections or piping.

B. Each pump used for domestic hot water return shall be installed with a shut-off valve and strainer installed in the suction side of the pump and a check valve, a balancing valve, and a shut-off valve in the discharge. Valves shall be the same size as the piping connecting the pump.

3.03 TRAINING:

A. Manufacturer's representative shall instruct the Owner’s maintenance personnel in the operation and proper care of the domestic booster equipment and a report shall be submitted to the Architect/Engineer.

END OF SECTION

SECTION 22 13 16 - DRAINAGE AND VENT SYSTEMS

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and **Division 20** Specification Sections, apply to work of this Section.

1.02 SUBMITTALS:

A. Product data for the following products:

1. Drainage piping specialties
2. Drainage pipe and fittings
3. Floor drains

B. Maintenance data for each piping specialty specified for inclusion in the Operation and Maintenance.

C. Inspection reports specified in Part 3 of this Section.

D. Test reports specified in Part 3 of this Section.

1.03 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with the provisions of the following:

1. Indiana Plumbing Code

1.04 SEQUENCING AND SCHEDULING:

A. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.

B. Coordinate with installation of sanitary sewer systems as necessary to interface building drains with drainage piping systems.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems components from one of the following:

1. Drainage Piping Specialties, including backwater valves, expansion joints, and vandal-proof vent caps:

a. Jay R. Smith Mfg. Co.
b. Josam Mfg. Co.
c. Wade/Tyler Pipe; Subs. of Tyler Corp.
d. Watts Drainage Products
e. Zurn Industries Inc.; Hydromechanics Div.

2. Heavy-duty No-Hub Couplings

a. Husky
b. Clamp-All
c. Mission Heavyweight

3. Freeze-proof vent caps:

a. Moore Mfg. Co.

4. Floor drains:

a. Jay R. Smith Co.
b. Josam Mfg. Co.
c. Wade/Tyler Pipe; Subs. of Tyler Corp.
d. Watts Drainage Products
e. Zurn Industries, Inc.

2.02 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS:

A. Hubless Cast-Iron Soil Pipe: CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310, and heavy duty coupling. Couplings shall be constructed of 304 stainless steel. Coupling sizes through 4” shall have 4 bands and sizes over 4” shall have 6 bands.

B. Pipe Size 2" and Smaller: Galvanized steel pipe, Schedule 40, ASTM A53; cast-iron screw joint drainage pattern fittings.

C. Pipe Size 2" and Smaller: copper D.W.V., ASTM B306. (NOT TO BE USED ON URINAL WASTE).

D. ABS Type DWV Plastic Pipe And Fittings ASTM D2661 pipe and fittings, with solvent cemented joints; DWV plastic fitting patterns shall conform to ASTM D2464.

1. Solvent: ASTM D2255

E. PVC, Type DWV Pipe and Fittings: ASTM D2665 pipe and fittings, with solvent cemented joints; DWV plastic fitting patterns shall conform to ASTM D2464.

1. Solvent: ASTM D2564

2.03 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS:

A. Cast-Iron Soil Pipe: CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310.

1. Neoprene Compression Gaskets: ASTM C564.

B. Hubless Cast-Iron Soil Pipe: CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310, and heavy duty coupling. Couplings shall be constructed of 304 stainless steel. Coupling sizes through 4” shall have 4 bands and sizes over 4” shall have 6 bands.

C. ABS Plastic Sewer Pipe: ASTM D2661 pipe and fittings.

1. Solvent: ASTM D2235.

D. PVC Sewer Pipe and Fittings: Conform to ASTM D2665 for pipe and fittings.

1. Solvent: ASTM D2564.

2.04 PVC FORCE MAIN PIPING:

A. Pipe Size 2" and Larger: PVC ASTM-D-2241 SDR 26, ASTM-D-1785, watrous grade pressure pipe.

B. Solvent-weld (cement) fittings are acceptable above and below ground. (On 4" and larger joints, mechanical clamping devices are required to seat and hold elements, while solvent cures.)

2.05 DRAINAGE PIPING SPECIALTIES:

A. Backwater Valves: Valve assembly shall be bronze fitted cast-iron, with bolted cover. Flapper shall provide a maximum 1/4 inch clearance between flapper and seat for air circulation. Valve ends shall suit piping material.

B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.

C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

D. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

E. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.

F. Frost-Proof Vent Caps: Construct of galvanized iron, copper, or lead-coated copper, sized to provide 1 inch air space between outside of vent pipe and inside of flashing collar extension.

G. Vandal-Proof Vent Caps: Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

H. Cleanouts

1. Floor Cleanouts: Cast-iron body and frames or combination cast-iron/ABS body and frame; brass cleanout plug; nickel-bronze adjustable round top. Manufacturer’s standard cast unit of pattern indicated as follows:

a. Pattern: Exposed flush type, standard non-slip scoriated finish; Jay R. Smith 4023. Nickel Bronze Round top.
b. Pattern: In carpeted areas, Polished Bronze flush type, standard non-slip scoriated finish, stainless steel carpet marker; Jay R. Smith 4023Y.
c. Pattern: In tile, Nickel Bronze, flush type, standard non-slip scoriated finish: Jay R. Smith 4143, round top.
d. Pattern: In terrazzo, Nickel Bronze, flush type, standard non-slip scoriated finish: Jay R. Smith 4183, round top.

2. Wall Cleanouts: Duco cast iron caulk ferrule with cast bronze taper threaded plug nickel bronze frame and polished bronze secured cover flush with wall like Jay R. Smith model 4435.

I. Floor drains:

1. General: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein.
2. Floor drain on Grade Type “FD-A”: Cast-iron body with integral trap and floor cleanout flashing collar, nickel bronze adjustable round strainer head with secured square hole grate; Jay R. Smith 2041-A.
3. Floor Drain on Grade Type “FD-B”: Cast-iron body with integral trap and floor cleanout and flashing collar, round nickel bronze adjustable strainer head with secured square hole grate and funnel; Jay R. Smith 3541-F11-6 with nickel bronze funnel.
4. Floor Drain (above grade) Type “FD-E”: For finished areas, cast-iron body and flashing collar, nickel bronze round adjustable strainer head with secured square hole grate and deep seal P-trap; Jay R. Smith 2005A.
5. Floor Drain (above grade) Type “FD-F”: For unfinished areas, cast-iron body, round cast-iron grate, sediment bucket, bottom outlet, clamping collar with C.I. deep seal P-trap; Jay R. Smith 2220-Y.
6. Floor Drain on Grade Type “FD-H”: For finished or non-finished areas beneath equipment with limited clearance. Cast-iron body with integral trap and floor cleanout, flashing collar, nickel bronze adjustable round strainer head & grate with Anti-flood rim recess; Jay R. Smith 2041-F37.
7. Floor Drain on Grade Type “FD-I”: For high volume discharge, cast-iron body with flashing collar and tractor grate, aluminum perforated sediment bucket. Modify for ¾” grate: Jay R. Smith 2450-13 and 4595 P-trap with 4223 floor cleanout.
8. Floor Drain (above grade) Type “FD-J”: For finished or non-finished areas beneath equipment with limited clearance, cast-iron body and flashing collar, nickel bronze adjustable round strainer head & grate with anti-flood rim recess and deep seal P-trap: Jay R. Smith 2005-F37.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

C. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

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

3.02 PREPARATION FOUNDATION FOR UNDERGROUND BUILDING DRAINS:

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

C. Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.03 PIPE APPLICATIONS – SANITARY DRAIN AND VENT PIPING ABOVE GROUND, WITHIN BUILDING:

A. Install ABS Type DWV Plastic Pipe and fittings for 10 inch and smaller drainage and vent pipe.

B. Install PVC Type DWV Plastic pipe and fittings for 10 inch and smaller drainage and vent pipe.

C. Install hubless, service weight, cast-iron soil pipe and fittings for larger than 10 inch drainage and vent pipe.

D. PVC piping shall not be installed in return air plenums. Verify location with HVAC plans.

3.04 PIPE APPLICATIONS - SANITARY DRAIN AND VENT PIPING BELOW GROUND, WITHIN BUILDING:

A. Install hub-and-spigot, service- weight, cast-iron, soil pipe and fittings with gasketed joints for 15 inch and smaller drainage pipe.

B. Install ABS plastic sewer pipe and fittings, with solvent cemented joints for 12 inch and smaller drainage pipe.

C. Install PVC sewer pipe and fittings with solvent cemented joints for 6 inch and smaller drainage pipe.

3.05 PIPE AND TUBE JOINT CONSTRUCTION:

A. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

B. ABS DWV Pipe: Joining and installation of ABS drainage pipe and fittings shall conform to ASTM D2661.

C. PVC DWV Pipe: Joining and installation of PVC drainage pipe and fittings shall conform to ASTM D2665.

D. ABS and PVC Sewer Pipe: Installation of underground ABS sewer pipe shall conform to ASTM D2321.

E. ABS to PVC Transition Joints: When joining ABS to PVC components (such as an ABS building drain to PVC sewer pipe) make joints using solvent cements conforming to ASTM D3138.

3.06 INSTALLATION:

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.

B. Use fittings for all changes in direction and all branch connections.

C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.

G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.

H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials. All piping penetrations through fire rated walls shall be cast iron.

I. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited

J. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

K. Install building drain pitched down at minimum slope of 1/4 inch per foot (2 percent) for piping 2 inch and smaller, and 1/8 inch per foot (1 percent) for piping larger than 2” unless otherwise noted on the Drawings.

L. Extend building drain to connect to sewer piping, of size and in location indicated for service entrance to building. Sewer piping is specified in a separate section of Division 2.

3.07 HANGERS AND SUPPORTS:

A. General: Hangers, supports, and anchor devices are specified in Section 20 01 40 "SUPPORTS AND ANCHORS". Conform to the table below for maximum spacing of supports.

B. Install the following pipe attachments:

C. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.

D. Install hangers at the following intervals:

PIPE MATERIAL	MAX HORIZ SPACING	MAX VERT SPACING
ABS Pipe	4	4
Cast-Iron Pipe	5	15
Copper Tubing - 1-1/4"		

and smaller	6	10
Copper Tubing - 1-1/2" and larger	10	10
PVC Pipe	4	4

3.08 INSTALLATION OF PIPING SPECIALTIES:

A. Install backwater valves in sanitary building drain piping as indicated, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.

B. Install expansion joints on vertical risers as indicated, and as required by the plumbing code.

C. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:

1. As required by plumbing code;
2. At each change in direction of piping greater than 45 degrees;
3. At minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
4. At base of each vertical soil or waste stack.

D. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.

E. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

F. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

G. Frost-Proof Vent Caps: Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1 inch clearance between vent pipe and roof substrate.

3.09 INSTALLATION OF FLOOR DRAINS:

A. General: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate flashing work with work of waterproofing and adjoining substrate work.

C. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

D. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring.

E. Maintain integrity of waterproof membranes, where penetrated.

F. Position drains so that they are accessible and easy to maintain.

G. Waterproof each floor drain above ground by providing a 16-inch x 16-inch flashing constructed in place using 40 mil chlorinated polyethylene sheets (Chloraloy 240). Install using manufacturers recommended procedure and in accordance with the Plumbing Code. Installation of flashing shall be coordinated with the floor construction.

3.10 CONNECTIONS:

A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.11 FIELD QUALITY CONTROL:

A. Inspections

1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

    a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
    b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

3. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.
4. Reports: Prepare inspection reports, signed by the plumbing official.

B. Piping System Test drainage and vent system as follows:

1. Test for leaks and defects in all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for all tests and required corrective action.

3.12 ADJUSTING AND CLEANING:

A. Clean interior of piping system. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.13 PROTECTION:

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

C. Exposed ABS or PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of a water-based latex paint.

END OF SECTION

SECTION 22 33 01 – COMMERCIAL ELECTRIC WATER HEATERS

GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

A. Extent of water heater work required by this Section is indicated on drawings and schedules, and by requirements of this Section.

B. Refer to other Division 20, 22 and 23 sections for water piping, specialties, and pumps which are required external to water heaters for installation; not work of this Section.

C. Electrical Work: Provide the following wiring as work of this Section, in accordance with requirements of Division 26:

1. Provide factory-mounted and factory-wired controls and electrical devices as specified in this Section.

D. Refer to Division 26 Sections for other electrical wiring including motor starters, disconnects, wire/cables, raceways, and other required electrical devices; not work of this Section.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of water heaters of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. UL Compliance: Construct water healers in accordance with the following UL standards:
2. UL 1453, “Electric Booster and Commercial Storage Tank Water Heaters”

C. Provide water heater components which are UL-listed and labeled.

D. NSF Compliance: Construct and install water healers located in food service establishments in accordance with NSF 5, “Standard for- Hot Water Generating Equipment for Food Service Establishments using Spray Type Dishwashing Machines."

E. NEC Compliance Install electric water heaters in accordance with requirements of NFPA 70, "National Electrical Code.”

F. NSF Labels: Provide water heaters which are listed and labeled by National Sanitation Foundation.

G. ASME Code Symbol Stamps: Provide water heater and safety relief valves which comply with ASME Boiler and Pressure Vessel Code and are stamped with appropriate code symbols.

H. ASHRAE Compliance: Provide water heaters with Performance Efficiencies not less than prescribed in ASHRAE 90.1.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data including rated capacities and efficiencies of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation and startup instructions.

B. Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring to water heaters. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of wafer heaters and controls. Differentiate between portions of wiring that are factory-installed and portions that are to be field-installed.

D. Maintenance Data: Submit maintenance data and parts lists for each type and size of water heater, control, and accessory; including “trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division-1.

E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

1.05 DELIVERY. STORAGE. AND HANDLING

A. Handle water heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged wafer heaters or components; remove from site and replace with new.

B. Store water heaters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage. :

C. Comply with manufacturer's rigging and installation instructions for unloading water heaters; and moving units to final location for installation.

PART 2 - PRODUCTS

2.01 COMMERCIAL ELECTRIC WATER HEATERS

A. General: Provide commercial electric water heaters of sizes, capacities, and electrical characteristics as indicated on schedule.

B. Heater: Working pressure of 150 PSI, magnesium anode rod; glass lining on internal surfaces exposed to water.

C. Heating Elements: Heavy-duty, medium watt density, with incoloy sheath, thermostat stepped through magnetic contactors.

D. Safety Controls: Double pole. manual reset, high limit; probe type electric low water cutoff; both factory wired.

E. Jacket: Equip with full size control compartments with front panel opening. Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with bonderized undercoat and baked enamel finish.

F. Accessories: Provide brass drain valve; 3/4" temperature and pressure relief valve; ASME tank construction for 125 PSI working pressure; and 4" x 6" hand-hole cleanout.

G. Controls: Adjustable immersion thermostat; power circuit fusing; pilot light and switch controlling control circuit; 3-stage time delay sequencer: and 7- day time clock.

H. Manufacturers: Subject to compliance with requirements, provide commercial electric water heaters of one of the following:

1. Smith Corp. (A.O.); Consumer Products Div.
2. State Industries, Inc.
3. Bradford White Corporation
4. Viking Superior Corp.

2.02 THERMAL EXPANSION ABSORBERS

A. Furnish and install where indicated on Contract Documents thermal expansion absorber constructed of materials suitable for potable water.

B. Size and number as indicated, constructed of welded carbon steel for **//125//150//** psig working pressure.

C. Separate air charge from system water to maintain design expansion capacity, by means of a flexible diaphragm securely sealed into the tank.

D. Provide taps for pressure gage and air charge fitting, and drain fitting. Support vertical tanks with steel legs or base: support horizontal tanks with steel saddles.

E. Tank, with taps and supports, shall be constructed, tested and labeled in accordance with ASME Pressure Vessel Code, Section VIII, Division 1.

F. Manufacturers: Subject to compliance with requirements, provide thermal expansion absorbers of one of the following:

1. Amtrol Inc.
2. Bell & Gossett ITT: Fluid Handling Div.
3. Armstrong Pumps, Inc.

PART 3 - EXECUTION:

3.01 EXAMINATION

A. Examine areas and conditions under which water heaters are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF WATER HEATERS

A. General: Install water heaters in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Place units on concrete pads, orient so controls and devices needing service and maintenance have adequate access.

C. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union. Extend relief valve discharge to closest floor drain, or as indicated.

D. Gages: Provide thermometers on inlet and outlet piping of water heaters, in accordance with Division 20 Basic Mechanical Materials and Methods Section “Meters and Gages.”

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

F. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with water heater startup until wiring installation is acceptable to water heater Installer.

3.03 INSTALLATION OF THERMAL EXPANSION ABSORBERS

A. General: Install thermal expansion absorbers in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Place units on concrete pads, orient so controls and devices needing service and maintenance have adequate access.

C. Piping: Provide cold water piping connections to units with unions.

3.04 FIELD QUALITY CONTROL

A. Startup: Startup, test, and adjust electric water heaters in accordance with manufacturer's startup instructions. Check and calibrate controls.

3.05 CLOSEOUT PROCEDURES

A. Training: Provide services of manufacturer's technical representative for 1- half day to instruct Owner's personnel in operation and maintenance of water heaters.

B. Schedule training with Owner, provide at least 7 day notice to Contractor and Engineer of training date.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

B. Separate grab bar and toilet accessories not an integral part of plumbing fixtures are specified in Division 10.

1.02 DESCRIPTION OF WORK:

A. Extent of plumbing fixtures work required by this Section is indicated on drawings and schedules, and by requirements of this Section.

B. Types of plumbing fixtures specified in this Section include the following:

1. Water closets
2. Urinals
3. Lavatories (including barrier free type)
4. Water coolers (including barrier free type)
5. Drinking fountains
6. Stainless steel sinks
7. Mop basins
8. Showers
9. Shower enclosures
10. Ice maker / refrigerator supply units
11. Washing machine supply units

C. Refer to Division 26 Sections for field-installed electrical wiring required for water coolers and other plumbing fixtures; not work of this Section.

1.03 QUALITY ASSURANCE:

A. Plumbing Fixture Standards: Comply with applicable portions of the Indiana Plumbing Code herein referred to as the Plumbing Code.

B. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems, and bath tub units including the following:

1. ANSI A112.6.1 – Supports for Off-the-Floor Plumbing Fixtures for Public Use.
2. ANSI A112.18.1 – Plumbing Fixture Fittings.
3. ANSI A112.19.1 – Enameled Cast Iron Plumbing Fixtures.
4. ANSI A112.19.2 – Vitreous China Plumbing Fixtures.
5. ANSI A112.19.3 – Stainless Steel Plumbing Fixtures (Designed for Residential Use).
6. ANSI Z358.1 – Emergency Eye Wash and Shower Equipment.

C. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.

D. NAHB Label: Provide fiberglass bath tub units and shower stalls which have been tested and labeled by NAHB Research Foundation, Inc.

E. UL Compliance: Construct water coolers in accordance with UL Standard 399 "Drinking-Water Coolers," and provide UL-listing and label.

F. ASHRAE Compliance: Test and rate water coolers in accordance with ASHRAE Standard 18 "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems."

G. ARI Compliance: Construct and install water coolers in accordance with ARI Standard 1010 "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers," and provide Certification Symbol.

H. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for making buildings and facilities accessible to and usable by physically handicapped people."

I. ASSE Compliance: ASSE 1037 – Flushometers (Pressurized Flushing Devices)

J. ADA Compliance: Construct and install barrier-free plumbing fixtures in accordance with Title III of the ADA of 1990 accessibility guidelines for buildings and facilities.

K. IBC Compliance: Construct and install barrier-free plumbing fixtures in accordance with IBC Chapter 11 - Accessibility for Public Accommodations and Commercial Facilities, as adopted and amended by the State of Indiana, latest enforced edition.

1.04 SUBMTTALS:

A. Product Data: Submit Manufacturer's Technical Product Data and installation instructions for each fixture, faucet, specialty, accessory, and trim specified; clearly indicate rated capacities of selected models of water coolers.

B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.

C. Maintenance Data: Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include this data and produce data in maintenance manual; in accordance with requirements of Division-1.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver plumbing fixtures, specialties, accessories, and trim individually wrapped in factory-fabricated containers.

B. Handle plumbing fixtures specialties, accessories, and trim carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures specialties, accessories, or trim; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL:

A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide trim and fittings including faucets, supplies, stops, traps, tailpieces, waste nipples, hangers, plates, brackets, anchors, supports, hardware, and fastening devices required for a complete installation.

B. All vitreous china plumbing fixtures shall be furnished by the same manufacturer for each product specified throughout.

C. All fixture trim shall be by same manufacturer for each product specified throughout.

2.02 MATERIALS:

A. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

B. Where fixture trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

C. Stainless Steel: ASTM A 167, Type 302/304, hardest workable temper, with No. 4 finish having, bright, directional polish on exposed surfaces.

D. Vitreous China: High Quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.

E. Fiberglass: ANS1 Z124, smooth surfaced, with color selected by Architect/Engineer.

F. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.03 WALL HUNG FLUSH VALVE WATER CLOSETS:

A. Water Closet (WC-1): 1.6 GPF, white vitreous china wall hung siphon jet elongated bowl with top spud.

1. American Standard 2257.101, Afwall; Kohler K-4430 Kingston.
2. ASSE 1037- Flushometer Valve;
   a. Sloan 8111, exposed, battery powered sensor operated quiet-operating diaphragm type, chrome plated flushometer valve, engineered metal infrared sensor housing with replaceable lens window. Valve shall be non-hold-open integral solenoid operator, courtesy flush override button, infrared sensor with indicator light, three second flush delay, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange.

3. Olsonite 95 white solid plastic open front integral check seat less cover.
4. J.R. Smith combination carrier fitting support with exposed flush valve supply support and anchor foot.

B. Water Closet (WC-1H): ADA compliant: 1.6 GPF, white vitreous china wall hung siphon jet elongated bowl with top spud.

1. American Standard 2257.101, Afwall; Kohler K-4430 Kingston.
2. ASSE 1037- Flushometer Valve;
   a. Sloan 8111, exposed, battery powered sensor operated quiet-operating diaphragm type, chrome plated flushometer valve, engineered metal infrared sensor housing with replaceable lens window. Valve shall be non-hold-open integral solenoid operator, courtesy flush override button, infrared sensor with indicator light, three second flush delay, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange. (Dual filtered type diaphragm kit.) (Offset valve to clear grab bar.)

3. Olsonite 95 white solid plastic open front integral check seat less cover.
4. J.R. Smith combination carrier fitting support with exposed flush valve supply support and anchor foot.

2.04 WASHOUT WALL HUNG URINALS:

A. Urinal (UR-1H): 1.0 GPF, white vitreous china wall hung wash-out urinal with extended shields, top spud, integral flush spreader and trap.

1. American Standard 6590.001, Washbrook; Kohler K-4960-ET Bardon.
2. ASSE 1037- Flushometer Valve;
   a. Sloan 8186-0.125, exposed, battery powered sensor operated quiet-operating diaphragm type, and chrome plated flushometer valve, engineered metal infrared sensor housing with replaceable lens window. Valve shall be non-hold-open integral solenoid operator, courtesy flush override button, infrared sensor with indicator light, three second flush delay, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange. 24 hour sentinel flush.

   b. Toto TEU1GNC-12, exposed, automatic infrared sensor activated, piston urinal flush valve. Heavy – duty zinc die cast cover with nickel chrome finish. Piston valve and solenoid with self cleaning mechanism. Self generating power system of hydro-powered turbine with backup battery. Courtesy flush override button, self-adaptive infrared sensor, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant hex head screws, stop cap and sweat solder adapter kit with cast set screw wall flange.

3. J.R. Smith 636 floor mount support.

2.05 STANDARD CHINA LAVATORIES:

A. Lavatory (LV-1H): 20”x 18" white vitreous china high back basin for concealed arm bracket with open grid strainer and with faucet holes on 8" centers.

1. American Standard 0355.012, Lucerne; Kohler K-2030, Greenwich.
2. American Standard Selectronic #6055.205 sensor operated faucet.
3. Grid strainer, drain assembly.
4. Adjustable two piece cast-brass P-trap with cleanout with escutcheon.
5. 1/2" I.P.S. x 3/8" O.D. loose key angle stop supplies with flexible risers and 1/2" chrome plated nipples and escutcheons.
6. J.R. Smith 700 floor mount concealed arm support.

2.06 SELF-RIMMING COUNTER INSERT BASINS:

A. Lavatory (LV-2/LV-2H): 19" diameter, white enameled cast iron self-rim counter insert basin with faucet holes on 8" centers.

1. American Standard 0476.028, Cadet; Kohler K-2917-8, Radiant.
2. American Standard Selectronic #6055.205 sensor operated faucet.
3. Grid strainer, drain assembly.
4. Adjustable two piece cast-brass P-trap with cleanout with escutcheon.
5. 1/2" I.P.S. x 3/8" O.D. loose key angle stop supplies with flexible risers and 1/2" chrome plated nipples and escutcheons.

6. Minimum cooling capacity 13.3 GPH (80 degrees entering to 50 degrees drinking at 90 degrees ambient).

2.07 WALL MOUNTED ELECTRIC WATER COOLERS:

A. Water Cooler (EWC-1H): Elkay #LZSTL8WSSK bi-level wall mount UL labeled self-contained electric water cooler with one-piece stainless steel top, stainless steel cabinet and bottle filler.

1. Unit to have steel mounting bracket, nonferrous waterways, built-in pressure regulator, automatically operated permanently lubricated air-cooled hermetically sealed cooling unit having freeze-up protection, and adjustable temperature control.
2. Electrical rating shall be 115 VAC, provide cord and plug.
3. Minimum cooling capacity 8 GPH (80 degrees entering to 50 degrees drinking at 90 degrees ambient).
4. Chrome plated straightway stop with supply tubing chrome plated nipples and escutcheons.
5. Provide 17 gauge adjustable P-trap with cleanout plug with escutcheon.

2.08 STAINLESS STEEL DOUBLE COMPARTMENT SINKS:

A. Double Compartment Sink (SK-1): 33" x 22" O.D. double compartment 18-gauge stainless steel self-rim counter insert four hole ledge sink with 8" deep bowl:

1. Proflo #PFSR332273.
2. American Standard Monterrrey #6405.140, single lever kitchen deck faucet.
3. Elkay LK-35 standard duo strainer with tailpiece.
4. Adjustable two-piece chrome plated cast-brass P-trap with cleanout with escutcheon.

5. Chicago Faucet 1017-CP supply pipes with loose key stops, lock shield caps, wall flanges, and flexible tube risers.

2.09 MOP BASINS:

A. Mop Basin (MB-1): 24" x 24" x 10”, molded stone receptor with brass drain body, stainless steel dome strainer-lint basket, vinyl bumper guards on exposed mop basin rims..

1. Fiat MSB2424
2. Chicago 897-CP supply fitting with integral stops, vacuum breaker, bucket hook, wall brace, and 3/4" hose thread on spout.
3. Fiat 832-AA, 30" long heavy-duty cloth reinforced rubber hose with stainless steel hose bracket, 833-AA silicone sealant.
4. Fiat 889-AA, stainless steel mop hanger with three rubber tool grips.
5. 12” high wall guard panels and corner bracket made with 20 gauge, 304 stainless steel and mounting hardware.

2.10 SHOWER ENCLOSURES:

A. Shower (SH-1): One-piece 63 x 38 1/2" x 80 7/8" acrylic module shower enclosure with integral soap ledges 2" shower drain and strainer assembly and curtain rod, factory installed.

1. Freedom APFQ6337BF875
2. Shower valve shall be Symmons 1-25-FSB-X-1.5, scald guard/mixing valve, vandal resistant metal handle adjustable high temperature limit stop, field set at 110 degree F.
3. 1/2" I.P.S. female inlets and outlets, screwdriver check stops, chrome plated finish.
4. Provide 60" flexible hose with spray head, in-line vacuum breaker, wall connection and flange.
5. Provide 30” chrome bar with adjustable slide.
6. Provide barrier free folding seat.

2.11 WASHING MACHINE SUPPLY UNITS:

A. Washing Machine Supply Unit: Guy gray B-200 control box with hot and cold water control valves and 2” drain connection. Mounting height as shown on drawings.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Installer of rough-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF PLUMBING FIXTURES:

A. General: Install plumbing fixtures of types indicated where shown and at indicated heights: in accordance with fixture manufacturer's written instructions, rough-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of The Americans with Disabilities Act of 1990, The Indiana Handicapped Code, ANSI A117.1 and The Plumbing Code pertaining to installation of plumbing fixtures.

B. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

C. Protect installed fixtures from damage during remainder of construction period.

D. Caulk around all wall or floor mounted fixtures using nonporous-bond silicone rubber mold/mildew resistant acid type sealant depositing a uniform continuous ribbon without gaps or air pockets, and with complete "wetting" of joint bond surfaces equally on opposite sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal and vertical surface, fill joints to form a slight cove, so that joint will not trap moisture and dirt.

E. Waterproof each shower room floor above ground by providing a completely waterproof pan constructed in place using 40 mil chlorinated polyethylene sheets (Chloraloy 240). Install using manufacturers recommended procedure and in accordance with the Plumbing Code. Joints and/or seams shall be welded type with comer ears first folded and then welded. Fabrication of pan shall be coordinated with the shower wall construction, with the fitting of the tile of prime importance.

F. Flush Controls designated as "barrier free" which are hand operated or automatic shall comply with The Americans with Disabilities Act of 1990, Article 4.16.5 and 4.27.4. Controls for flush valves shall be mounted on the wide side of toilet areas no more than 44 inches above the floor to centerline of trip lever/push button for use by adults, and no more than 32" above the floor to centerline of trip lever/push-button for use by children in elementary schools.

G. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

H. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site and then retest to demonstrate compliance: otherwise, remove and replace with new units and proceed with retesting.

I. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

3.03 ADJUSTING AND CLEANING:

A. Clean plumbing fixtures, trim and strainers of dirt and debris upon completion of installation.

B. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.

C. Adjust or replace washers to prevent leaks at faucets and stops.

3.04 EXTRA STOCK:

A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every 10 units.

END OF SECTION

SECTION 23 05 93 - ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.01 WORK DESCRIPTION:

A. Scope of Work:

1. Test, adjust, and balance the chilled water systems, the air moving equipment, and the air supply, return, and exhaust systems as herein specified.

B. Work Included:

1. Adjust fans and volume dampers to deliver, return or exhaust design air quantities to or from each space.
2. Adjust terminal units to deliver design air quantities.
3. Adjust supply, return, exhaust, and relief dampers.
4. Adjust individual outlets for proper air movement.
5. Balance cooling water for design system flow.
6. Balance domestic hot water return loop.

1.02 QUALITY ASSURANCE:

A. Test and Balancing Agencies must be certified by NEBB or AABC:

B. Authorization of Report:

1. All reports shall be certified by an officer of the organization.

1.03 CONDITIONS:

A. System Operation:

1. Heating, ventilating, air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the adjusting and balancing work specified.

1.04 AGENCY LISTING:

A. Submit name of the Test and Balancing Agency to Architect/Engineer as a subcontractor on the Materials and Subcontractors Listing.

B. If the Contractor fails to submit name of selected Test and Balance Agency, the Architect/Engineer will select the agency of his choice and Contractor shall then issue purchase order for this work as directed.

1.05 MEASUREMENTS:

A. Readjustments:

1. Should corrective measure caused by faulty installation require re-testing, adjusting and balancing, such work shall be done by the agency at no change in contract price.

2. Corrective measures that are required to be made to the installed work to provide proper balancing results shall be the responsibility of the Contractor.

3. New sheaves and belts required to produce the specified air volumes shall be furnished by the Contractor at no cost to Adjusting and Balancing Agency. Installation shall be by Adjusting and Balancing Agency under supervision of a representative of the equipment manufacturer.

4. New pump impellers required to produce the specified water flow will be furnished and installed by the Contractor.

6. Any new electric motors other than those scheduled that are required to obtain or accomplish design requirements are not a part of this contract.

PART 2 - PRODUCTS

2.01 INSTRUMENTS:

A. Quality:

1. The minimum instrumentation for testing, adjusting, and balancing shall be the "AABC Approved Minimum Field Instrumentation."

2. Instruments used for testing and balancing must have been calibrated within a period of six (6) months and checked for accuracy prior to start of work.

3. Instruments must be maintained and carried in such manner to protect them from excessive vibration and moisture conditions.

B. Approval:

1. All products and instrumentation used shall be subject to approval of the Architect/Engineer.

2.02 REPORTS:

A. Report Forms:

1. Submit specimen copies of report forms for approval prior to start of balancing work.

2. Reports shall be on standard forms similar to those published by the AABC or NEBB.

B. Final Report:

1. Upon completion, all information shall be neatly typed and submitted to the Architect/Engineer with accompanying schematic diagrams of systems tested.

2. All test reports shall be assembled, indexed, and submitted in PDF format.

PART 3 - EXECUTION

3.01 PROCEDURE:

A. Methodology:

1. Testing and balancing shall be performed in complete accordance with National Standards for Field Measurements and Instrumentation.

3.02 PREPARATION:

A. Air System:

1. Prior to system testing and balancing:

a. Systems shall be fully operational.
b. All filters shall be clean.
c. Temperature and system controls shall be checked for proper operation.
d. Fan rotation shall be checked.

B. Water Systems:

1. Prior to system testing and balancing:

a. Open all valves to full open position. Close coil by-pass stop valves. Set mixing valves to full coil flow.
b. Remove all strainers and clean same.
c. Examine water in system and determine if water has been treated and cleaned.
d. Check pump rotation.
e. Clean and set automatic fill valves for required system pressure.
f. Check expansion tanks to determine that they are not air bound and the system is completely full of water.
g. Check air vents at high points of water systems and determine if all are installed and operating freely.
h. Set all temperature controls so all coils are calling for full cooling. Same procedure when balancing hot water coils, set for full heating.
i. Check operation of automatic by-pass valve if furnished.
j. A complete air balance must be accomplished before beginning the water system test and balance.

3.03 SYSTEMS BALANCE:

A. Air Systems:

1. Perform the following minimum test and balance:

a. Test and adjust supply, return, and exhaust fans to design requirements. Change sheaves and belts as required to obtain design air quantities.
b. Test and record motor electrical characteristics, RPM, service factor, measure voltage, full load amperes and connected load amperage. Check and record starter heaters sizes and rating, replacement belts sizes, etc.
c. Make pitot tube traverse (minimum of 16 point) of main supply ducts and obtain design CFM at fans. Seal all test holes with suitable hole plugs.
d. Test and record system static pressures, suction, and discharge.
e. Test and adjust system for design CFM recirculated air.

f. Test and adjust system for design CFM outside air.
g. Test and record entering air temperatures. (D.B. heating and cooling)
h. Test and record entering air temperatures. (W.B. cooling)
i. Test and record leaving air temperatures. (D.B. cooling)
j. Test and record leaving air temperatures. (W.B. cooling)
k. Adjust all main supply and return air ducts to proper design CFM.
l. Adjust all zones to proper design CFM, supply, and return.
m. Test and adjust each diffuser, grilles, and register to within 10% of design requirements.
n. Each grille, diffuser, and register shall be identified as to location and area. Size, type, flow factor, and manufacturer of diffusers, grilles, registers, and all tested equipment shall be identified and listed.
o. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, requirement CFM and test resultant CFM after adjustments.
p. In cooperation with the Temperature Control Contractor's representative, setting adjustments of automatically operated dampers to operate as specified, indicated, and/or noted. The Balance Agency shall check all controls for proper calibrations and list all controls required adjustment by the Temperature Control Contractor.
q. All diffusers, grilles, and registers shall be adjusted to minimize drafts in all areas.
r. Adjust all pressure independent or maximum volume regulators, whether factory or field supplied, for scheduled air flow on all terminal boxes.
s. Adjust air directional vanes on air curtain discharge nozzles so that air split occurs approximately 12” above the floor, 3” outside the centerline of the doorway. Verify that air is directed to both the inside and outside of the doorway. Refer to manufacturer’s adjusting procedures.

B. Water Systems:

1. Perform the following minimum water system test and balance:

a. Set water pumps to proper gallons per minute delivery.
b. Adjust water flow through equipment.
c. Check leaving water temperatures and return water temperature. Reset to correct design temperatures.
d. Check water temperatures at inlet side of coils. Note rise or drop of temperatures from source.
e. Proceed to balance each water coil.
f. Upon completion of flow readings and adjustments at coils, mark all settings and record data.
g. After adjustments to coils are made, recheck settings at the pumps and readjust if required.
h. Install pressure gauges in gauge fittings provided on coil, read pressure drop through coil at set flow rate for full cooling and on full heating. Set pressure drop across by-pass valve to match coil full flow pressure drop.

C. VAV Systems: Where variable volume systems are specified and/or denoted, the following general guidelines are to be used in balancing the systems. Note specific items of importance to the equipment manufacturer and the system application that must be adhered to.

1. Check and note the following items on the supply fan:

a. Correct fan rotation
b. Filter condition (clean or dirty, as specified)

c. Cooling coil condition (dry or wet)

2. Set the control for the supply fan to operate at maximum capacity and for all variable volume dampers to be at the full open position.

3. Set the system up to operate with maximum return air and minimum outside air.

4. The following preliminary data should be obtained at the supply fan:

   a. Fan and motor RPM
   b. Motor and current voltage
   c. Fan, coils and filter statics
   d. Nameplate data on the fans and motors
   e. Motor sheave, fan pulley and belt sizes

5. Traverse the main supply duct(s) and return duct(s) to determine CFM deliveries of the fans.

   a. Set the system to operate at 100% outside air and check the motor amperage. The motor amperage should remain relatively constant indicating no change in total air flow. If a change in flow does occur, adjust outside air, return air, and relief air dampers, accordingly.

NOTE: If the system is designed with diversity, set enough variable volume controllers throughout the building to maximum in order to simulate a maximum load on the fan.

6. Measure the system duct static pressure at selected points throughout the system. These monitoring points should be in those duct runs which are of the longest equivalent length (greatest friction loss). Monitor these points during the adjusting and balancing procedures to assure proper inlet static pressure is being maintained to the variable volume units.

7. Adjust the supply fan to the point where the static pressure at the end of each branch is at required static pressure.

NOTE: If the fan is adjusted to obtain the minimum static pressure, then it may be necessary to readjust the fan during the balancing as the static pressure will decrease as the constant volume controller deliveries are increased.

8. Make preliminary outlet readings and balance the outlets to design CFM.

9. Individually set the controls for each variable volume damper to full heat and read the outlets.

10. Adjust the damper minimum position so the VAV box outlet total CFM is at the design minimum delivery.

11. Read and adjust the minimum and maximum settings on all variable air volume (VAV) boxes and fan powered boxes.

12. Replace VAV box volume regulators found to be defective during the balancing process. Spare volume regulators shall be furnished by the VAV box manufacturer and installed to replace defective regulators during the balancing phase of the project. He shall provide 5% of the box total or a quantity of 5, whichever is greater. Defective volume regulators shall be returned to the VAV box manufacturer for replacement and the total quantity of spares will be given to

the Owner for his use at the completion of the project. The VAV box manufacturer shall be required to check, adjust and place all boxes in proper operating condition if the Test and Balance Contractor finds more than 15% of the boxes not operating properly mechanically (linkage, actuator, damper, etc.) The VAV box manufacturer will not be required to field adjust factory calibration of PI controls.

13. Test and Balance Contractor shall read and adjust supply fan setting on fan powered variable air volume boxes.

14. Check the following controls:

    a. Economizer system-function, calibration and damper synchronization.
    b. Return and outside air dampers-function and calibration.
    c. High temperature lit shut-off-function and calibration.
    d. Low temperature limit shut-off-function and calibration.

15. Set all controls to their normal set points and allow controllers to reach satisfied state.

16. Measure the mixed air plenum static pressure to verify that the capacity controller is functioning properly. The static pressure in the plenum should be within .05" W.C. of the final balance condition.

17. Walk through the building and listen for noise generated by the air distribution system. Excessive noise should be reported.

3.04 RECORD DATA:

A. Air Systems:

1. Record the following minimum data:

    a. CFM delivery and RPM of blowers and fans.
    b. Static pressure at inlet and outlet of blowers and fans.
    c. All equipment nameplate data.
    d. Actual running current and voltage of fan motors.
    e. CFM delivery or exhaust at each diffuser, register, or grille.

B. Water System:

1. Record the following minimum data at each heating and cooling element:

    a. Inlet water temperature.
    b. Leaving water temperature.
    c. Pressure drop of each coil.
    d. Pressure drop across by-pass.
    e. Pump operating suction and discharge pressures and final T.D.H.
    f. List all mechanical specifications of pumps. Check and record starter size, heater sizes, etc.
    g. Rated and actual running amperage of pump motor.
    h. Water balance device readings and/or settings.

3.05 SERVICES:

A. Re-inspection:

1. Balancing Agency shall make two (2) return inspection trips to the project within the one year warranty period of the project; one at near heating design conditions and one during air conditioning design conditions for the purpose of checking out those portions of the system that are not performing satisfactorily as determined by the Engineer. Balancing Agency shall make any additional adjustments required at this time.

END OF SECTION

SECTION 23 09 00 – ENERGY MANAGEMENT SYSTEM

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.02 WORK INCLUDED:

A. The Temperature Control Contractor (TCC) shall provide the following:

1. Extension of existing BAS to new terminal units..
2. Complete temperature control system to be DDC as specified herein.
3. All wiring, conduit, panels, for all DDC environmental controls.
4. All final electrical connections to each stand-alone Application Specific Controller and DDC Controller.
5. Contractor shall be responsible for all electrical work associated with the BAS control system and as called for on the Drawings. Perform all wiring in accordance with all local and national codes.
6. Install all line voltage wiring, concealed or exposed, in accordance with Division 26.
7. Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers, Application Specific Controllers and operator's workstations.

B. The Mechanical Contractor shall provide:

1. Installation of control devices, alarms, monitoring devices and control valves.
2. All package unit control panels.

C. The Sheetmetal Contractor shall provide:

1. Installation of dampers; outdoor air, return air, exhaust air and vent dampers; with adjacent access doors and all flow monitoring stations that are not an integral part of the equipment.

D. The Electrical Contractor shall provide:

1. 120 volt, 20 amp circuit for each DDC Controller.
2. Final connection to TCC equipment shall be by TCC.
3. 120 volt power to all variable volume terminal units.

1.03 GENERAL SYSTEM DESCRIPTION:

A. The system is existing. New terminal units shall be integrated into the existing system functions including equipment supervision and control, alarm management, energy management and historical data collection.

B. The system shall consist of the following:

1. DDC Controller
2. Application Specific Controllers
3. Terminal Equipment Controllers

C. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, Application Specific Controllers, Terminal Equipment Controllers and operator devices.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

E. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. The operator shall not have to know the panel identifier or location to view or control an object. Application specific controllers shall be constantly scanned by the network controllers to update point information and alarm information. Communication between control panels shall utilize BACNet protocol.

F. DDC Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central processing device. DDC Controllers shall, also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

1.04 QUALITY ASSURANCE:

A. Materials and equipment shall be the cataloged products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

B. The system shall be installed using competent workmen who are fully trained in the installation of temperature control equipment.

C. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system.

D. Supplier shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory, and all necessary test and diagnostic equipment.

E. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

F. The control system shall comply with UL 916 PAZX and UL 864 UDTZ, and be so listed at the time of bid.

G. Design and build all system components to be fault-tolerant:

1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3 Hertz variation in line frequency.
2. Static, transient and short-circuit protection on all inputs and outputs.
3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.
4. Network-connected devices to be A.C. coupled or equivalent so that any single device failure will not disrupt or halt network communication.
5. The DDC Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

1.05 SUBMITTALS:

A. Manufacturer's Product Data indicating all equipment components.

B. Shop Drawings with the following information:

1. System wiring diagrams with sequence of operation for each system as specified.
2. Submit manufacturer's product information on all hardware items along with descriptive literature for all software programs to show compliance with specifications.
3. System configuration diagram showing all panel types and locations as well as communications network and workstations.

C. 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 Architect/Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received.

D. Operation and Maintenance (O & M) Manuals

1. Provide three printed sets of O & M Manuals in binders
2. Provide two optical media (CD or DVD) backups of all software date files and product data.
3. Provide two optical media (CD or DVD) backups of files of all color graphics screens created for this project.
4. Integrate access to O & M information at operator workstations.
5. In addition to device data, O & M manuals shall include procedures for operating the systems, establishing and logging trends, handling alarms, creating reports, changing setpoints and other variables, overriding computer control, designing new points and graphic screens and general system debugging/maintenance.

PART 2 - PRODUCTS

2.01 NETWORKING COMMUNICATIONS:

A. General: The design of the BAS shall network operator workstations, DDC Controllers, Application Specific Controllers and Terminal Equipment Controllers. The network architecture shall consist of two levels, a high performance peer-to-peer network incorporating BACnet protocol between workstation and master control panels and Controller-specific local area networks for the Application Specific Controllers and Terminal Equipment Controllers using the or BACNET protocols. Communication on the terminal equipment level shall incorporate peer-to-peer networking.

B. Access to system data shall not be restricted by the hardware configuration of the building automation system. The hardware configuration of the BAS network shall be totally transparent to the user when accessing data or developing control programs.

C. Network Level:

1. Operator workstations and DDC Controllers shall directly reside on a network such that communications may be executed directly between DDC Controllers, directly between workstations and between DDC Controllers and workstations on a peer-to-peer basis.

2. All operator devices, either network resident or connected via dial-up modems, shall have the ability to access all point status and application report data or

execute control functions for any and all other devices via the peer-to-peer network. Access to data shall be based upon logical identification of building equipment.

D. Network design shall include the following provisions:

1. Provide high-speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices. System performance shall insure that an alarm occurring at any DDC Controller is displayed at workstations and/or alarm printers within 5 seconds.

2. Support of any combination of DDC Controllers and operator workstations directly connected to the peer-to-peer network. A minimum of 32 devices shall be supported on a single network.

3. Detection and accommodation of single or multiple failures of workstations, DDC panels, or the network media. The network shall include provisions for automatically reconfiguring itself to allow all operational equipment to perform their designated functions as effectively as possible in the event of single or multiple failures.

4. Message and alarm buffering to prevent information from being lost.

5. Error detection, correction and retransmission to guarantee data integrity.

6. Default device definition to prevent loss of alarms or data, and ensure alarms are reported as quickly as possible in the event an operator device doesn't respond.

7. Commonly available, multiple sourced, networking components and protocols shall be used to allow the BMS to coexist with other networking applications such as office automation. ETHERNET, Modbus, TCP/IP and ARCNET are acceptable technologies.

8. Use of an industry standard IEEE 802.x protocol.

9. Synchronization of real-time clocks, to include automatic daylight savings time updating between all Building Controllers shall be provided.

E. DDC Controller Local Area Network (LAN):

1. This level communication shall support a family of application specific controllers and shall communicate bi-directionally with the peer-to-peer network through DDC Controllers for transmission of global data.

2. Application specific controllers shall communicate on a peer-to-peer basis. All controllers shall reside directly on the LAN and not be dependent on another controller for communication to other controllers.

2.02 DDC CONTROLLERS

A. General. Provide DDC Controllers to provide the performance specified in Part 1. Each of these panels shall meet the following requirements.

1. The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based DDC Controllers to manage the global strategies described in System software section.

2. The DDC Controller shall have sufficient memory to support its operating system, database, and programming requirements.

3. The controller shall provide a communications port for connection of the Portable Operators Terminal using Point to Point BACnet physical/data link layer protocol or a connection to the inter-network.

4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

5. Controllers that perform scheduling shall have a real time clock.

6. Data shall be shared between networked DDC Controllers.

7. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:

   a. Assume a predetermined failure mode.

   b. Generate an alarm notification.

8. BACnet. The DDC Controller shall use the Read (Initiate) and Write (Execute) Services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135-95, to communicate with BACnet objects in the internetwork. Objects supported shall include: Analog input, analog output, binary input, binary output, device.

B. Communications. Each DDC Controller shall reside on a BACnet inter-network using the ISO 8802-3 (Ethernet). At the owner's option, each workstation and DDC Controller shall reside on the Enterprise wide network provided by the owner and supporting the Internet Protocol (IP). Communications shall use Annex J of ASHRAE Standard 135-95. Each DDC Controller shall also perform routing to a network of Custom Application and Application Specific Controllers.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at 0 C to 50 C [32 F to 120 F].

D. Serviceability. Provide diagnostic LED's for power, communications, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.

E. Memory. The DDC Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage.

2.03 DDC CONTROLLER RESIDENT SOFTWARE FEATURES:

A. General: All necessary software to form a complete operating system as described in this specification shall be provided.

B. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.

C. Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

D. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

E. Upon the resumption of normal power, each DDC Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.

F. DDC Controllers shall have the ability to perform any or all the following energy management routines:

1. Time-of-day scheduling
2. Calendar-based scheduling
3. Holiday scheduling
4. Temporary schedule overrides
5. Start-Stop Time Optimization
6. Automatic Daylight Savings Time Switchover
7. Night setback control
8. Enthalpy switchover (economizer)
9. Peak demand limiting
10. Temperature-compensated duty cycling
11. Fan speed/CFM control
12. Heating/cooling interlock
13. Cold deck reset
14. Hot deck reset
15. Hot water reset
16. Chilled water reset
17. Condenser water reset
18. Chiller sequencing

G. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operations.

H. DDC Controllers shall be able to execute custom, job specific processes defined by the user, to automatically perform calculations and special control routines. It shall be possible to use any of the following in a custom process:

1. All point values (physical and virtual) must be accessible to the operator
2. Any system measured point data or status
3. Any calculated data
4. Any results from other processes
5. User-defined constants
6. Arithmetic functions (+, -, *, /, square root, exp., etc.)
7. Boolean logic operators (and/or, exclusive or, etc.)
8. On-delay/off-delay/one-shot timers

I. Custom processes may be triggered based on any combination of the following:

1. Time interval
2. Time-of-day
3. Date
4. Other processes
5. Time programming
6. Events (e.g., point alarms)

J. A single process shall be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network.

K. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.

L. The custom control-programming feature shall be documented via English language descriptors.

M. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost.

N. At no time shall the DDC Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200-character alarm message to more fully describe the alarm condition or direct operator response. Each DDC Controller shall be capable of storing a library of at least 50 alarm messages. Each message may be assignable to any number of alarms in the Controller.

2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.

4. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

5. If connection to the Internet at the workstation is available, the operator shall be able to direct the alarm message via an e-mail to a web based pager service. The message will then be automatically routed to e-mail enabled devices.

O. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data.

1. DDC Controllers shall store point history data for selected analog and digital inputs and outputs. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group.

2. Trend data shall be stored at the DDC Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval or manual command. All trend data shall be available for use in 3rd party personal computer applications.

3. A “Snapshot” Trend function shall be available that is triggered on a change of state, i.e., alarm, contact closure, etc. When triggered, the previous historical values of operator-defined points shall be captured and saved. The operator shall be able to designate the capture of any points in the system and the previous interval of sampling time.

P. Runtime totalization: DDC Controllers shall automatically accumulate and store runtime hours for binary input and output points as specified in the Sequence of Operation.

1. The totalization routine shall have a sampling resolution of one minute or less.

2. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.

Q. Analog/Pulse Totalization: DDC Controllers shall automatically sample, calculate, and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input type points.

1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units(e.g. KWH, gallons, KBTU, tons, etc.)

2. The Totalization routine shall have a sampling resolution of one minute or less.

3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

R. Event Totalization: DDC Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off.

1. Event totalization shall be performed on a daily, weekly or monthly basis for each air handling unit and each pump.

2. The event totalization feature shall be able to store the records associated with a minimum of 9,999.9 events before reset.

3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

2.04 APPLICATION SPECIFIC CONTROLLER:

A. Stand-alone Controllers shall be microprocessor-based with a minimum word size of 16 bits. They shall also be multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements for all operations required by this specification. An operator shall be able to view temperatures, pressures and setpoints and with a password change all required setpoints. A notification shall be annunciated at the workstation if a setpoint is overridden at the local display. LonTalk or BACNet protocol is to be used for all Application Specific Controllers.

B. Each Controller shall have sufficient memory to support its own operating system and database, including:

1. Control processes
2. Energy management applications
3. Maintenance support applications
4. Custom processes
5. Operator I/O
6. Manual override monitoring

C. Each Controller shall support monitoring of the following types of inputs, without the addition of equipment outside the Controller cabinet:

1. Analog Inputs

   a. 4-20 mA
   b. 0-10 Vdc
   c. Thermistors
   d. 1000 ohm RTDs

2. Digital Inputs

   a. Dry Contact Closure
   b. Pulse Accumulator
   c. Voltage Sensing

D. Each Controller shall be capable of providing the following control outputs without the addition of equipment outside the DDC Controller cabinet:

1. Digital Outputs

   a. Contact closure (motor starters, sizes 1-4)

2. Analog Outputs

   a. 4-20 mA
   b. 0-10 Vdc

E. Provide all processors, power supplies and communication controllers complete so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

F. Provide sufficient internal memory for the specified control sequences with at least 25% of the memory available for future use.

G. Controllers shall provide a communication connection for programming and troubleshooting.

H. Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

I. The operator shall have the ability to manually override automatic or centrally executed commands at the Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points. As an option, the controller may incorporate and LCD display that will allow overrides to be executed by a password authorized operator using the touch pad screen.

1. Switches shall be mounted either within the DDC Controller's key- accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been overridden.

3. DDC Controllers shall also collect override activity information for reports.

J. Each Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The Controller shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication.

K. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

L. In the event of the loss of normal power, there shall be an orderly shutdown of all Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

1. Upon restoration of normal power, the Controller shall automatically resume full operation without manual intervention.

2. Should Controller memory be lost for any reason, the user shall have the capability of reloading the Controller via the local communication port or from a network workstation PC.

2.05 TERMINAL EQUIPMENT CONTROLLERS:

A. Provide for control of each piece of equipment, including, but not limited to, the following:

1. VAV Terminal Boxes
2. CV Terminal Boxes

B. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Terminal equipment controllers utilizing proprietary control signals and actuators shall not be acceptable. Controllers shall communicate with the DDC Controller.

C. Terminal equipment controllers shall support the following types of point inputs and outputs:

1. Economizer Switchover Inputs

a. Drybulb
b. Outdoor Air Enthalpy
c. Differential Temperature
d. Binary Input from a separate controller

2. Economizer Outputs

a. Integrated Analog with minimum position
b. Binary output to enable self-contained economizer actuator

3. Heating and Cooling Outputs

a. 1 to 3 Stages

b. Analog Output with two-pipe logic
c. Reversing valve logic for Heat Pumps
d. Tri-state modulating actuators with spring return as required for application.

4. Fan Output

a. On/Off Logic Control

D. Terminal equipment controllers shall support the following library of control strategies to address the requirements of the sequences described in the Sequence of Operation portion of this specification, and for future expansion:

1. Daily Schedules
2. Comfort/Occupancy Mode
3. Economy Mode

a. Standby Mode/Economizer Available
b. Unoccupied/Economizer Not Available
c. Shutdown

4. Lighting Logic Interlock to Economy Mode
5. Temporary Override Mode

a. Temporary Comfort Mode (Occupancy-Based Control)

E. Occupancy-Based Economy/Comfort Mode Control: Each Controller shall have a provision for occupancy sensing overrides. Based upon the contact status of either a manual wall switch or an occupancy sensing device, the Controller shall automatically select either an Economy or Comfort mode.

F. Temporary Override Modes:

1. Temporary Occupancy Mode: The controller interface to the zone temperature sensor shall allow for an optional momentary switch to change the mode of the controller from economy to comfort and optionally interlock the room lights for a preset amount of time.

G. Alarm Management: Each Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

H. Space Temperature Control: Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type providing the following minimum performance requirements are met:

1. Accuracy: + 1 F
2. Operating Range: 20 to 120 F
3. Set Point Adjustment Range: to 95 F
4. Set Point Modes: Independent Heating, Cooling, Night Setback-Heating , Night Set up - Cooling
5. Calibration Adjustment: None required
6. Installation: Up to 100 ft. from controller

I. Each room sensor shall also include the following auxiliary devices:

1. Set point Adjustment Dial
2. Override and Cancel Switch

J. The set point adjustment dial shall allow for modification of the temperature by the occupant. Set point adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator at the central workstation, DDC Controller, or via the portable operator's terminal.

K. An override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator at the central workstation, DDC Controller or via the portable operator's terminal.

L. Each controller shall perform its primary control function independent of other DDC Controller LAN communication, or if LAN communication is interrupted.

M. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the DDC Controller time clock to insure LAN continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field- adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings. Controllers that incorporate proportional and integral (PI) control algorithms only shall not be acceptable.

N. Provide each terminal equipment controller with sufficient memory to accommodate point databases and operating programs. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 72- hour backup shall be provided. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Provide uninterrupted power supplies (UPSs) of sufficient capacities for all terminal controllers that do not meet this protection requirement.

O. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.

2.06 WORKSTATION OPERATOR INTERFACE:

A. BASIC INTERFACE DESCRIPTION:

1. Operator workstation interface software shall minimize operator training through the use of English language prompting, English language point identification and industry standard PC application software. The software shall provide, as a minimum, the following functionality:

   a. Graphical viewing and control of environment
   b. Scheduling and override of building operations
   c. Collection and analysis of historical data
   d. Definition and construction of dynamic color graphic displays
   e. Editing, programming, storage and downloading of controller databases
   f. Integration with O & M data for devices

2. Provide a graphical user interface which shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change set points from graphical displays through the use of a mouse or similar pointing device.

a. Provide functionality such that all operations can also be performed using the keyboard as a backup interface device.

b. Provide additional capability that allows at least 10 special function keys to perform often-used operations.

3. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. The mouse shall be used to quickly select and switch between multiple applications. This shall be accomplished through the use of Microsoft Windows or similar industry standard software that supports concurrent viewing and controlling of systems operations.

4. Provide functionality such that any of the following may be performed simultaneously, and in any combination, via user-sized windows:

a. Dynamic color graphics and graphic control
b. Alarm management coordinated with DDC Controller alarm management function
c. Time-of-day scheduling
d. Trend data definition and presentation
e. Graphic definition
f. Graphic construction

5. Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password. The system manager shall be able to assign, by operator, individual access to point types, application programs and graphics. For example, an operator in a multiple building campus can be restricted to view/change only their building objects, while a higher password will allow access to all buildings on the WAN.

a. A minimum of 50 unique passwords, including user initials, shall be supported.
b. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed shall be limited to only those items defined for the access level of the password used to log-on.
c. The system shall automatically generate a report of log-on/log-off time and system activity for each user.
d. User-definable, automatic log-off timers of from 5 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices on-line.

6. Software shall allow the operator to perform commands including, but not limited to the following:

a. Start-up or shutdown selected equipment
b. Adjust set-points
c. Add/Modify/Delete time programming
d. Enable/Disable process execution
e. Lock/Unlock alarm reporting for points
f. Enable/Disable totalization for points
g. Enable/Disable trending for points
h. Override PID loop set-points
i. Enter temporary override schedules
j. Define holiday schedules
k. Change time/date
l. Automatic daylight savings time adjustments

m. Enter/Modify analog alarm limits
n. Enter/Modify analog warning limits
o. View limits
p. Enable/Disable demand limiting for each meter
q. Enable/Disable duty cycle for each load

B. REPORTS AND LOGS

1. General: Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archived on the hard disk for historical reporting. Provide the ability for the operator to obtain real time logs of designated lists of objects. Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. The operator shall be able to designate reports that shall be printed or stored to disk at selectable intervals.

2. Custom Reports: Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.

3. Standard Reports. The following standard system reports shall be provided for this project. These reports shall be readily customized to the project by the owner.

a. Electrical Meter Report: Provide a monthly report showing the daily electrical consumption and peak electrical demand for each building meter. Provide an annual (12 month) summary report showing the monthly electrical consumption and peak demand for each meter.

b. Gas Meter Report: Provide a monthly report showing the daily natural gas consumption for each meter. Provide an annual (12 month) report that shows the monthly consumption for each meter.

c. Weather Data Report: Provide a monthly report showing the daily minimum, maximum and average outdoor air temperature and the number of heating and cooling degree days for each day. Provide an annual (12 month) report showing the minimum, maximum and average outdoor air temperature for the month and the number of heating and cooling degree days for the month.

d. Tenant Override Reports: Provide a monthly report showing the daily total time in hours that each tenant has requested after hours HVAC and lighting services. Provide an annual summary report that shows the override usage on a monthly basis.

e. ASHRAE Guideline 3-1996 Report: Provide a daily report that shows the operating condition of each chiller as required by ASHRAE Guideline 3. At minimum this report shall include:

(1) Chilled Water (or other fluid) inlet and outlet temperature
(2) Chilled Water (or other fluid) flow
(3) Chilled Water (or other fluid) inlet and outlet pressures
(4) Evaporator refrigerant pressure and temperature
(5) Condenser refrigerant pressure and liquid temperature
(6) Condenser water inlet and outlet temperatures

(7) Condenser water flow
(8) Refrigerant levels
(9) Oil pressure and temperature
(10) Oil level (if applicable)
(11) Compressor refrigerant discharge temperature
(12) Compressor refrigerant suction temperature
(13) Manual entry field for addition of refrigerant
(14) Manual entry field for addition of oil
(15) Manual entry field for vibration levels
(16) Motor amperes per phase
(17) Motor volts per phase
(18) PPM refrigerant monitor levels
(19) Purge exhaust time or discharge count
(20) Ambient temperatures (dry bulb and wet bulb)
(21) Date and time data logged

C. SCHEDULING:

1. General: Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. The spreadsheet shall show a representation of a monthly calendar. Events shall be able to be schedule at least 5 years in advance as a minimum. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:

2. Weekly Schedule. Provide separate schedules for each day of the week.

3. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to two years in advance. The input of an Exception shall change the color of the day on the calendar to indicate an Exception is scheduled.

4. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period. The input of a Holiday shall change the color of the day on the calendar to indicate a Holiday is scheduled.

5. Optimal Start/Stop. The scheduling application outlined above shall support an optimal start/stop algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start/stop algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.

D. COLLECTION AND ANALYSIS OF HISTORICAL DATA:

1. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time.

2. Any system point, physical or virtual, may be trended automatically at time-based intervals or changes of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting.

3. Trend data report graphics shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or pre-defined groups of at least 6 points. Provide additional functionality to allow any trended data to be transferred easily to an off-the-shelf spreadsheet package such as Microsoft Excel. This shall allow the user to perform custom calculations such as energy usage, equipment efficiency and energy costs and shall allow for generation of these reports on high-quality plots, graphs and charts.

E. DYNAMIC COLOR GRAPHIC DISPLAYS:

1. Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water system and hot water system, shall be provided by the BAS contractor to optimize system performance analysis and speed alarm recognition.

2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.

3. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.

4. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several graphics at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

5. Graphic generation software shall be provided to allow the user to add, modify or delete system graphic displays.

   a. The BAS contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit component s (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.

   b. The graphic development package shall use a mouse or similar pointing device in conjunction with a drawing program to allow the user to perform the following:

      (1) Define symbols
      (2) Position and size symbols
      (3) Define background screens
      (4) Define connecting lines and curves
      (5) Locate, orient and size descriptive text
      (6) Define and display colors for all elements
      (7) Establish correlation between symbols or text and associated system points or other displays

6. The Operator shall be able to create graphical displays to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout or any other logical grouping of points which aids the operator in the analysis of the facility. To accomplish this, the user shall be able to build graphic displays that include point data from multiple DDC

Controllers including Application Specific Controllers used for DDC equipment or VAV terminal unit control.

7. A target button shall be included on the Home graphic that will automatically display the Sequence of Operations for this project. The method of display may be either in Microsoft Word or a text graphic. The text shall be modified at the Acceptance of the project to reflect any changes that occurred in the Sequence from the time of submittal to the finalization of the software.

    a. Target buttons at each sublevel screen shall be included which will automatically display the Sequence of Operations for just the portion of the system displayed.

8. A target button shall be included on the Home graphic that will automatically display the O & M data for the project. The method of display may be either in Microsoft Word or text graphic. O & M data sheets shall include identifying marks which correspond to labels on other graphic screens, allowing an operator to determine the correct data sheet for a particular device in the system.

F. SYSTEM CONFIGURATION AND DEFINITION:

1. All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

2. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:

    a. Add/delete/modify stand-alone DDC Controller panels
    b. Add/delete/modify operator workstations
    c. Add/delete/modify application specific controllers
    d. Add/delete/modify points of any type and all associated point parameters and tuning constants
    e. Add/delete/modify alarm reporting definition for points
    f. Add/delete/modify control loops
    g. Add/delete/modify energy management applications
    h. Add/delete/modify time and calendar-based programming
    i. Add/delete/modify totalization for points
    j. Add/delete/modify historical data trending for points
    k. Add/delete/modify custom control processes
    l. Add/delete/modify any and all graphic displays, symbols and cross-reference to point data
    m. Add/delete/modify dial-up telecommunication definition
    n. Add/delete/modify all operator passwords
    o. Add/delete/modify alarm messages

3. Definition of operator device characteristics, DDC Controllers individual points, applications and control sequences shall be performed using instructive prompting software.

4. Libraries of standard application modules such as temperature, humidity and static pressure control shall be available for use as "building blocks" in defining or creating new control sequences. In addition, the user shall have the capability to easily create and archive new modules and control sequences as desired via a word processing type format. Provide a library of standard forms to facilitate definition of point characteristics. Forms shall be self-prompting and incorporate a fill-in-the-blank approach for definition of all parameters. The system shall

immediately detect an improper entry and automatically display an error message explaining the nature of the mistake.

5. Inputs and outputs for any process shall not be restricted to a single DDC Controller, but shall be able to include data from any and all other network panels to allow the development of network-wide control strategies. Processes shall also allow the operator to use the results of one process as the input to any number of other processes (cascading).

6. Provide the capability to backup and store all system databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller. Similarly, changes made at the DDC Controllers shall be automatically uploaded to the workstation, ensuring system continuity. The user shall also have the option to selectively download changes as desired.

7. Provide context-sensitive help menus to provide instructions appropriate with operations and applications currently being performed.

2.07 FIELD DEVICES:

A. SENSING:

1. All sensing inputs shall be provided via industry standard signals. Temperatures, humidities, differential pressure signals, and other signal inputs shall be one of the following types:

a. 0-20 mA
b. 4-20 mA
c. 0-5 VDC
d. 0-10 VDC
e. 1000 ohm platinum
f. 1000 ohm Balco
g. Thermistor (Manufacturer's Standard Thermistor)

2. All signal inputs shall be compatible with the controllers used, and with the requirement for read-out of variables in true-scaled engineering units as specified.

B. ANALOG INPUT SENSORS:

1. Analog sensing devices shall be available for the measurement of common variables such as temperature, static pressure, differential pressure, humidity, fluid flow, etc.

2. All devices shall be standard manufactured for the purpose intended with an output range as specified.

C. TEMPERATURE SENSORS:

1. Shall be the manufacturer's standard sensors suitable for the controller and the application and meeting the accuracy and performance requirements of the sequence of operation.

2. When thermowells are required, sensor and well shall be supplied as a complete assembly including well head. Thermal conductive compound shall be used in sensor/well assembly.

3. Thermowell construction shall be compatible with the medium being measured. All thermowells and sensors shall be mounted to allow easy access to the sensor for repair or replacement and installed as part of the piping work.

4. Duct mount sensors shall be mounted through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A seal shall be used on the sensor assembly to prevent air leaks.

5. Averaging bulb sensors shall be mounted on 3/8" rods in a serpentine fashion. The sensing bulb may be attached to the framework of a coil provided that insulated standoffs are used and the bulb is carefully strung to prevent contact with any coil surfaces.

6. Space temperature sensor covers shall be durable, impact resistant material finished in acceptable color or acceptable metallic finish.

7. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed and equipped with solar shields.

8. Accuracies: as follows, including errors associated with sensor, lead wire and A to D converter.

Point Type	Accuracy	Range
Outside Air Temperature	1.0 Deg. F.	-30 to 120 Deg. F
Chilled Water Temperature	1.0 Deg. F.	20 to 120 Deg. F
Space Temperature	1.5 Deg. F.	20 to 120 Deg. F
Hot Water Temperature	2.0 Deg. F.	32 to 212 Deg. F
Duct Temperature	1.0 Deg. F.	20 to 120 Deg. F
Sensors Used in Calibrations	0.5 Deg. F.	----------

D. ELECTRONIC HUMIDITY SENSORS:

1. Humidity sensors shall utilize an all polymer, capacitive humidity sensing element to measure the relative humidity (RH) over the entire range 0% to 100% RH, and send a proportional 0-10 VDC or 0-5 VDC signal to the system's controller.

2. Humidity sensor shall be resistant to corrosion in harsh environments and shall have no minimum air flow requirements.

3. Humidity sensor shall have an accuracy of ± 3% RH for 5-95% RH and ± 5% RH for 0-5% and 95-100% RH.

E. PRESSURE SENSORS:

1. Pressure sensor construction shall be compatible with the medium being measured.

2. All pressure sensors shall be sized to withstand two times (2x) the average operating pressure without damage, and to hold calibrated accuracy when subjected to a momentary forty percent (40%) over-range input.

3. Pressure measurement accuracy shall be within 1 percent (1%) of the span over an ambient operating temperature range of 30 degrees F. to 140 degrees F.

4. Differential pressure sensors and transmitters used for flow measurement shall be sized to the flow sensing device and shall be supplied with the proper shutoff and bleed valves as required for maintenance or replacement.

F. PRESSURE DIFFERENTIAL SWITCHES:

1. Pressure differential switches shall incorporate corrosion resistant, sensing elements of bourdon tube, bellows or diaphragm type, shall have tamperproof adjustable range and differential pressure settings and shall operate automatically and reset automatically when conditions return to normal.

2. Pressure sensor switch contacts shall be snap action type.

3. Complete Sensor Assembly shall be protected against vibration at all critical movement pivots, etc.

G. RELAYS:

1. Snap acting, enclosed switching type, with built-in 120V to 24V/60 Hz transformer, 24V coil, and line voltage contacts as indicated, each rated minimum 7.4 amp running current at 120VAC.

2. Snap acting NEMA 1 enclosed switching type with 120V/60 Hz coil and line voltage contacts, as indicated, each rated minimum 7.2 amp running current at 120VAC.

3. Snap acting, rated for application, minimum 2 sets of Form C contacts, enclosed in dust-proof enclosure.

   a. Contacts: Silver-cadmium with minimum life span rating of 1,000,000 operations.
   b. Operating time: 20 milliseconds or less.
   c. Release time: 10 milliseconds or less.
   d. All relays equipped with coil transient suppression devices to limit transients to non-damaging levels.

H. CURRENT SENSING RELAYS:

1. Sensing relay shall be a solid-state electronic device with split-core design to eliminate the need to remove power conductor for installation or servicing.

2. Amperage rating shall be suitable for range of amperage of equipment monitored.

3. Trip setpoint shall be adjustable to +/- 1% of range. Provide a trip LED.

4. Sensor supply current is induced from monitored conductor. Minimum conductor current required is 2 Amps. Provide a power LED to indicate that power is available at the current sensing relay.

5. Sensor shall have 600 VAC rms isolation.

6. Switch output contacts shall be rated for 0.5 Amps @ 30 VAC/DC.

7. Switch shall be Neilsen - Kuljian SC-250, Veris or approved equal.

I. AIR DIFFERENTIAL PRESSURE SWITCHES:

1. Shall be differential pressure type with adjustable range from .05 to 1.0 inches water gauge. Contacts shall be snap acting SPDT and rated for 10 Amps (non-inductive) 120 VAC.

J. WIRE AND CABLE:

1. General: provide wire and cable including communication media not included as work of another contract.

2. Control wiring:

   a. All control wiring for 24VAC and 12OVAC control shall be minimum 14 gauge.

   b. Control wiring for Digital or Analog Functions: shielded 2 or 3 wire to match function hardware. 18 AWG minimum,

   c. Control wire or cable: shall be installed in accordance with **<Division 26><Division 16>** Specification.

   d. Do not install Class 2 wiring in conduit with Class 1 wiring.

3. All branch and trunk wire and cable installed in return air spaces above ceilings shall be installed in conduit or shall be plenum rated for the duty.

4. Label all wiring, including within factory-fabricated panels, within 2” of termination. All labels shall be self-laminating polyester. Do no use hand written labels.

K. LOW TEMPERATURE DETECTION THERMOSTATS:

1. Electric thermostats with 20 foot sensing element shall be arranged in a grid across the air inlet side of cooling coils in every air handling system except 100% recirculation systems, or systems receiving tempered ventilation air from other systems.

2. Low temperature detection thermostats: manual reset, line voltage type, with flexible sensing elements 20 feet long, responsive to low temperature along the entire length. Furnish two (2) thermostats wired in series, each set at 38 degrees F. (adjustable) with sensing elements laced across coil.

L. CARBON DIOXIDE SENSORS:

1. Provide manufacturer’s standard sensors suitable for the demand control of ventilation.

   a. Molded plastic enclosure suitable for wall mounting, to reliably and accurately measuring and transmitting CO2 levels.
   b. Rating: 0 to 5,000 ppm; operating 0 deg F to 120 deg F
   c. Range: 0 - 2,000 ppm / 0 – 5,000 ppm (user selectable)
   d. Accuracy: +/- 50 ppm.
   e. Output: 0 – 10 vDC, 0 – 20 mA or 4 – 20 mA

M. MOISTURE SENSORS:

1. Provide leak detection moisture sensor equal to WaterBug Water Sensor WB 200 as manufactured by Winland Electronics, Inc. Device shall include SPDT Form “C” contacts rated at 1 Amp at 24 VAC resistive/ 1AMP at 30 VDC resistive for connection to the EMS.

PART 3 - EXECUTION

3.01 RELATED WORK:

A. Division 20, 21, 22 and 23 - Mechanical

B. Division 26 - Electrical

C. Refer to Division 20 and 23 sections for installation of instrument wells, valve bodies, and dampers in mechanical systems; not work of this section.

D. Refer to Division 26 sections for the following work; not work of this Section:

1. Power supply wiring for power source to power connection on controls and/or unit control panels. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

E. The Temperature Control Contractor shall provide the following electrical work as work of this section, complying with requirements of Division 26 sections:

1. Interlock wiring between electrically operated equipment units; and between equipment and field-installed control devices.
2. Control wiring between field-installed controls, indicating devices, and unit control panels.

3.02 VERIFICATION AND DEMONSTRATION OF OPERATION:

A. At the completion of system installation, demonstrate to the Architect/Engineer and the Owner that all sequences are functioning correctly, and explain to the Owner's personnel the step-by-step operation of starting, running, and stopping of all equipment and the maintenance of the controls.

3.03 HARDWARE INSTALLATION:

A. The following clarification shall be used to identify the level of controller required for each type system control:

B. Variable Air Volume Terminals Provide Terminal Equipment Controllers.

C. Exhaust Fans, Various Other Mechanical Systems Provide control from Terminal Equipment Controller or Application Specific Controllers as needed.

3.04 SOFTWARE LICENSE AGREEMENT:

A. A copy of the Manufacturer's standard software and firmware licensing agreement shall be provided for the Owner's signature defining all rights and obligations to be assumed by the Owner for use of the system. Such license shall grant use of all programs and application software to Owner, but shall protect Manufacturer's rights to disclosure of trade secrets contained within such software.

3.05 ON-SITE TESTING

A. General: Provide Owner-approved operation and acceptance testing of the complete system. The Owner will witness all tests.

B. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line.

C. All testing, calibrating, adjusting and final field tests shall be completed by the installer. Provide a cross-check of each control point with in the system by making a comparison between the control command and the field- controlled device.

D. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Submit the results of functional and diagnostic tests to the Owner for final system acceptance.

E. Compliance Inspection Checklist: Submit in the form requested, the following items of information to the Owner's Representative and Architect/Engineer for verification of compliance to the project specifications. Failure to comply with the specified information shall constitute non-performance of the contract. The contractor shall submit written justification for each item in the checklist that he is unable to comply with. The Owner's Representative and the Architect/Engineer will initial and date the checklist to signify contractor's compliance before acceptance of system.

F. Verify to the Owner's Representative, in letter form, that supplier has in-place a support facility.

G. Manually generate an alarm at a remote DDC Controller as selected by the Architect/Engineer to demonstrate the capability of the workstation and alarm printer to receive alarms.

H. Disconnect the graphical workstation to demonstrate the capability of the system to remain under control when the workstation is disconnected from the system.

I. At a DDC Controller of the Owner's choice, display on the portable operator's terminal at least one temperature setpoint and at least one status condition, i.e., on or off for a system or piece of equipment attached to that panel as well as for points at another device on the network.

J. Demonstrate the ability to add a new point to the DDC Controller with the portable operator’s terminal and upload it to the workstation to modify that panel's stored database.

K. At an ASC of the Owner's choice, disconnect the LAN connection to demonstrate its lack of reliance on a DDC Controller to maintain full control functionality.

3.06 SERVICE AND GUARANTEE

A. General: Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after completion of successful performance test or date of Substantial Completion, whichever is later. Provide necessary material required for the work.

B. A one-year preventive maintenance and support agreement shall be included at no additional cost to the owner. This agreement shall begin at acceptance of the BAS by the owner and conclude at the end of the warranty period. This agreement shall include setting up trends on the major pieces of equipment on the project and review of the trends on a monthly basis with a hard copy forwarded to the owner. A technician shall visit the site quarterly and consult with the owner of owner’s representative to address any desired changes to the system. The technician shall also advise or recommend to the owner ways to enhance the operation of the current system if applicable.

C. Minimize impacts on facility operations when performing scheduled adjustments and non-scheduled work. The adjustment and repair of the system includes all computer equipment, software updates, transmission equipment and all sensors and control devices. Provide the manufacturer's required adjustments and all other work necessary.

D. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the initial performance test.

E. Systems Modifications: Provide any recommendations for system modification in writing to Owner. Do not make any system modifications, including operating parameters and control settings, without prior approval of Owner. Any modifications made to the system shall be incorporated into the Operations and Maintenance Manuals, and any other documentation affected.

F. Software Updates: Provide all software updates in the form of service packs or patches that may have been issued subsequent to the start of construction, and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with the Owner, and shall be incorporated into the operations and maintenance manuals, and software documentation. All updates shall result in a system that is the latest version of the manufacturer's software at the time of Substantial Completion. All software updates shall be provided at no additional cost to the Owner.

3.07 TRAINING:

A. The Contractor shall provide competent instructors to give full instruction to Owner designated personnel in the adjustment, operation and maintenance of the system installed.

B. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 7:30 a.m. to 4:00 p.m. weekdays as follows.

C. Provide 24 hours of training for Owner's operating personnel. Training shall include:

1. Explanation of drawings, operations and maintenance manuals
2. Walk-thru of the job to locate control components
3. Operator workstation and peripherals
4. DDC Controller and ASC operation/function
5. Operator control functions including graphic generation and field panel programming
6. Operation of portable operator's terminal
7. Explanation of adjustment, calibration and replacement procedures.

D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If such training is required by the Owner, it will be contracted at a later date. Provide description of available local and factory customer training.

END OF SECTION

SECTION 23 31 13 - LOW PRESSURE DUCTWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

1.02 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.03 WORK DESCRIPTION:

A. Scope of Work:

1. Furnish and install low pressure ductwork as shown or implied on the Contract Documents.

2. Extent of the work is indicated on the Drawings and in the schedules, and by requirements of this section. Low pressure ductwork is hereby defined as ductwork subjected to velocities of less than 2500 fpm or less and operating pressure of 2” water column (w.c.) or less, positive or negative.

B. Work Included:

1. Heating supply and return air duct systems.
2. Air conditioning supply and return duct systems.
3. Supply ducts on discharge side of mixing box.
4. Mechanical exhaust ducts.
5. Gravity exhaust systems.
6. Fresh air supply systems.
7. Return air runouts from trunk to register or grille.
8. All other ducts shall be considered high pressure ducts.

1.04 QUALITY ASSURANCE:

A. Construction Standards:

1. All ducts shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards”.

2. Where SMACNA standards provide no guidance, comply with ASHRAE Handbook of Fundamentals chapter on Duct Construction.

3. Comply with ANSI/NFPA 90A “Standard for the Installation of Air-Conditioning and Ventilating Systems” and ANSI/NFPA 90B “Standard for the Installation of Warm Air Heating and Air-Conditioning Systems”.

1.05 SUBMITTALS:

A. Submit descriptive literature and shop drawings for manufactured products and factory fabricated ductwork in accordance with Division 1 requirements.

B. Submit complete dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation of space enclosure. At a minimum, the following items will be required to be indicated on the duct layout submittals:

1. Drawings shall be submitted in AutoCAD format. Hand drawn documents are not acceptable.
2. Ductwork layout on reflected ceiling plans to 1/4" = 1'-0" scale.
3. Fire damper installation and locations.
4. Access door installations and locations.
5. Duct sizes and fabrication methods.
6. All required transitions and noted whether they are flat on top, flat on bottom, or concentric.
7. All field seams required and the proper method of joint shall be indicated.
8. All sections to be internally lined shall be indicated, and the increased dimensions shall be noted.
9. All sections that are to be installed with flexible ductwork shall be indicated.
10. Volume dampers, motorized dampers, turning vanes, and extractor installation, fabrication and locations.
11. Hanging and supporting details.
12. Drawings shall show ductwork elevations in relation to ceiling height with clearance worked out between ductwork, piping, electrical fixtures, and structure.

1.06 RECORD DRAWINGS:

A. Submit Record Drawings in accordance with Division 1 requirements.

1.07 DELIVERY, STORAGE AND HANDLING:

A. Protect shop fabricated and factory fabricated ductwork, accessories and purchased products from damage during shipment, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store ductwork inside and protect from the weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Metal duct:

1. U.S. Steel
2. Republic Steel
3. Wheeling Steel
4. Norfolk

B. Metal duct accessories:

1. Ductmate Industries, Inc.

C. Factory Fabricated Round or Oval Ductwork

1. C & R
2. Dixie Sheetmetal
3. Eastern Sheetmetal
4. JTD Spiral
5. Lapine Metal Products
6. Lindab
7. Semco
8. Tangent Air
9. United Sheetmetal Div. United McGill Corp.

D. Duct Liner

1. Certainteed “ToughGard”
2. Knauf E-M

E. Duct sealant:

1. United Duct Sealant
2. Hardcast

2.02 DUCTWORK:

A. General: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual defects and imperfections including fittings, seam markings, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet metal steel complying with ANSI/ASTM A 653, lockforming quality and ANSI/ASTM A 653M, G90 zinc coating; mill phosphatized for exposed locations.

C. Rectangular Ductwork:

1. Ductwork shall be fabricated of gages and reinforcement complying with SMACNA Standards, and shall be of sizes as shown on Drawings. Dimensions as shown are inside measurements indicating free area required. Ducts noted to receive liner shall be increased in size to maintain the inside dimensions noted.

2. Minimum rectangular duct sheet metal gauges shall be as follows:

Dimension of Longest Side	Gauge
0 - 26"	26
27 - 30"	24
31 - 36"	22
37 - 84"	20
85 - 120"	18
121 - 144”	16

D. Round Ductwork:

1. Round ducts shall be factory fabricated zinc coated steel of spiral lockseam construction.

2. Round duct fittings shall be factory fabricated zinc coated steel for 45 or conical take-off from the main trunk.

3. Minimum round duct metal gauges for low pressure ductwork shall be as follows:

Duct Diameter	Gauge	Fitting Gauge
0 - 14"	28	24
15 - 26"	26	24
27 - 36"	24	22
37 – 50"	22	20
51 – 60"	20	18
61 - 84"	18	16

2.03 MISCELLANEOUS DUCTWORK MATERIALS:

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Duct Liner Adhesive: Comply with American Society for Testing and Materials (ASTM) ASTM 916 "Specifications for Adhesives for Duct Thermal Insulation." Duct liner shall be adhered to the sheet metal and, where required, edges coated with one of the adhesives conforming to the Standard for Adhesives for Duct Liner, ASC-A-7001C-1972, of the Adhesive and Sealant Council, Inc.

C. Duct liner shall be further secured with fasteners conforming to the Mechanical Fastener Standard, MF-1-1975, on page 22 of the Duct Liner Application Standard, second edition, of the Sheet Metal and Air Conditioning Contractor's National Association.

D. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

E. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

F. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

G. For exposed stainless steel ductwork, provide matching stainless steel support materials.

H. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

2.04 INTERNAL DUCT LINER:

A. Duct-Liner: Fibrous glass, complying with American Society for Testing Materials (ASTM) ASTM C 1071; of thickness indicated. be 1" thick composed of long textile type glass fibers firmly bonded in random orientation with a thermosetting phenolic resin minimum density of 1.5 lb/cu.ft,, thermal conductivity of 0.24 at 75 F differential, minimum sound absorption co-efficient of 0.67 at 500 Hz based upon ASTM Test Method C-423-60T,and able to withstand velocities up to 4000 feet per minute.

B. Unless otherwise indicated, the net free area of the duct dimensions given on the Drawings shall be maintained. Increase metal duct dimensions as necessary to compensate for addition of the liner.

C. The interior duct insulation shall be applied as recommended by the manufacturer including proper adhesive and adhered clips. Clip spacing shall not exceed 8" on center perpendicular to air flow and shall not exceed 12" on center in the direction of air flow.

D. All joints of the insulation shall have edges buttered with sealant, and shall be tightly buffed. Apply a brush coat of sealant at all joints on the surface of the duct liner extending at least 1" on each side of joint.

E. Provide metal nosing on all exposed edges of duct liner at fire dampers, control dampers, fan discharges, etc.

F. Liner may be adhered to the sheet metal before it is formed into ducts provided care is taken not to damage the insulation.

EDIT THE NEXT TWO SECTIONS VERY SPECIFICALLY TO THE PROJECT REQUIREMENTS!

G. The following ductwork shall be internally lined:

1. Rectangular supply air ductwork
2. Rectangular return air ductwork
3. Relief air duct and plenums up to the suction of the fan

H. The following ductwork shall be externally insulated and is work of another section:

1. Fresh air ducts and plenums
2. Relief air duct between the relief or motorized shut-off damper and the outside louver, including the relief plenum
3. See Specification Section 15250 for examples of other ductwork that does not require liner

PART 3 - EXECUTION

3.01 GENERAL:

A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5 % leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints.

B. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold duct true-to shape and to prevent buckling.

C. Provide all necessary offsets and transformations as required in the installation of the work although same may not be specifically shown on the plans. Offset all ducts as required to increase head room under them, to improve the appearance of exposed ducts, and to avoid interference with the work of other trades.

D. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible.

E. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment.

F. Hold ducts close to walls overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.

G. Where possible, in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, furring, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate the layout with suspended ceiling and lighting layouts and similar finished work.

H. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on four sides by at least 1-1/2".

I. Where ducts pass through time-rated fire resistive construction, all openings around the ducts shall be sealed with fire stopping material.

J. Provide angle, channel, or equal type frames for all manual and automatic dampers and install as required.

K. In toilet exhaust systems serving two or more floors, install featherweight backdraft damper in the branch ductwork to each floor.

L. Provide drain pans at built up air handling systems. Provide multiple drain pans at multiple cooling coil sections.

M. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

N. Support ductwork in manner complying with SMACNA 1995 Second Edition, "HVAC Duct Construction Standards" hanger and supports Section.

3.02 INSTALLATION OF RECTANGULAR DUCTWORK:

A. Field changes in duct dimensions shall result in equivalent cross-sectional areas to dimensions shown. In no case shall the greater dimension be greater than four times the lesser.

B. All transitions shall be made with long transition fittings. Ducts shall be flared to suit shape of registers and grilles or openings for registers and grilles. Maximum angle of transition of 20 for diverging air flow and 30 for contracting air flow.

C. Provide engineered air foil blades turning vanes at square elbows, minimum 2 1-1/2" wide, where shown on the drawings, and where changes in direction cannot be made as specified above. Turning vanes shall be installed inside the insulation on internally lined ducts.

D. All rectangular sheet metal ducts over 18" in width shall be cross broken or mechanically beaded to reduce vibration. Reinforcing angle and stiffeners shall be provided where required to prevent sagging, buckling, vibration, sound transmission, etc.

E. Changes in direction shall be made with easy flowing curves. The minimum center line radius of bends shall be at least 1-1/2 times the dimension of the duct in the plane of the turn unless otherwise shown. Radius type elbows fabricated with the inside radius equal to width of duct; short radius elbows will be permitted only by written approval of Architect/Engineer for specific cause.

F. Ducts shall be fabricated to a minimum of SMACNA 2" pressure classification.

G. All ducts shall be sealed to meet SMACNA Class B classification. Both longitudinal and transverse joints are to be sealed.

3.03 INSTALLATION OF ROUND DUCTWORK:

A. Ducts shall be assembled so that they are free of obstructions, smooth on the inside and airtight.

B. All branch takeoffs from trunk ducts shall be made with a cone shaped adapter to the trunk duct. The adapter shall be 2" more in dimension than the branch and shall taper to branch duct size with the side of the adapter not exceeding 15 degrees from the horizontal.

C. In low pressure ductwork, spin-in fittings may be used for round branch take-offs from rectangular duct.

3.04 JOINTS:

A. Dissimilar metals shall have a heavy coat of zinc primer applied at connection point to keep surfaces from direct contact with each other.

3.05 FIRE DAMPERS AND COMBINATION FIRE-SMOKE DAMPERS:

A. Fire dampers and combination fire-smoke dampers shall be installed in all ducts passing through fire rated walls and elsewhere as shown on the Drawings as required by the Indiana Building Code. All installations shall be in strict accordance with manufacturer's recommendations in compliance with their rating.

B. Access sections, panels and/or doors shall be installed adjacent to each fire damper, smoke damper or combination fire-smoke damper.

3.06 LINTELS:

A. Mechanical Contractor shall be responsible for furnishing and installing lintels over all ducts that pass through load bearing walls and any duct over 12" wide. Lintel size shall be sufficient to support loads above. Lintel material shall be as approved by the Architect/Engineer. Lintels shall be installed by craftsmen skilled in this particular trade.

END OF SECTION

SECTION 23 31 14 - HIGH PRESSURE DUCTWORK

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.02 WORK DESCRIPTION:

A. Scope of Work:

1. Furnish and install high pressure ductwork as shown or implied on the Contract Documents.
2. Extent of the work is indicated on the Drawings and in the schedules, and by requirements of this section. High pressure ductwork is hereby defined as ductwork subjected to velocities greater than 2500 fpm and operating pressure greater than 2” water column (w.c.), positive or negative.

B. Work Included:

1. Heating supply and return air duct systems.
2. Air conditioning supply and return duct systems.
3. Fresh air supply systems.
4. All other ducts shall be considered low pressure ducts.

1.03 QUALITY ASSURANCE:

A. Construction Standards:

1. All ducts shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards.
2. Where SMACNA standards provide no guidance, comply with ASHRAE Handbook of Fundamentals chapter on Duct Construction.
3. Comply with ANSI/NFPA 90A “Standard for the Installation of Air-Conditioning and Ventilating Systems” and ANSI/NFPA 90B “Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
4. All ducts shall be UL listed and labeled Class I.
5. All ductwork furnished with factory installed insulation and vapor barriers shall be UL listed and labeled for a flame spread and smoke producing rating of 25 and 50 respectively and listed Class I.

B. Pressure Classifications:

1. Supply, return, and relief ducts in penthouses and mechanical rooms shall be constructed to 10" water column classification.
2. All other supply ducts shall be constructed to 4" water column classification.
3. All other return air ducts shall be constructed to 3" water column classification.

1.04 SUBMITTALS:

A. Submit descriptive literature and shop drawings for manufactured products and factory fabricated ductwork in accordance with Division 1 requirements.

B. Submit complete dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation of space enclosure. At a minimum, the following items will be required to be indicated on the duct layout submittals:

1. Drawings shall be submitted in AutoCAD format. Hand drawn documents are not acceptable.
2. Ductwork layout on reflected ceiling plans to 1/4" = 1'-0" scale.
3. Fire damper installation and locations.
4. Access door installations and locations.
5. Duct sizes and fabrication methods.
6. All required transitions and noted whether they are flat on top, flat on bottom, or concentric.
7. All field seams required and the proper method of joint shall be indicated.
8. All sections to be internally lined shall be indicated, and the increased dimensions shall be noted.
9. All sections that are to be installed with flexible ductwork shall be indicated.
10. Volume dampers, motorized dampers, turning vanes, and extractor installation, fabrication and locations.
11. Hanging and supporting details.
12. Drawings shall show ductwork elevations in relation to ceiling height with clearance worked out between ductwork, piping, electrical fixtures, and structure.

1.05 RECORD DRAWINGS:

A. Submit Record Drawings in accordance with Division 1 requirements.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Protect shop fabricated and factory fabricated ductwork, accessories and purchased products from damage during shipment, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store ductwork inside and protect from the weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Metal duct:

1. U.S. Steel
2. Republic Steel
3. Wheeling Steel
4. Norfolk

B. Metal duct Accessories:

1. Ductmate Industries, Inc.

C. Factory Fabricated Round or Oval Ductwork

1. C & R
2. Dixie Sheetmetal
3. Eastern Sheetmetal

4. JTD Spiral
5. United Sheetmetal Div. United McGill Corp.
6. Semco
7. Tangent Air
8. U.S. Air Duct
9. Lapine Metal Products
10. SPIROsafe; Div. Of Lindab

D. Duct Liner

1. Certainteed “ToughGard”
2. Knauf E-M

E. Duct sealant:

1. United Duct Sealant
2. Hardcast

2.02 GENERAL:

A. Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual defects and imperfections including fittings, seam markings, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet metal steel complying with ANSI/ASTM A 653, lockforming quality and ANSI/ASTM A 653M, G90 zinc coating; mill phosphatized for exposed locations.

C. Painted Sheet Metal: Where architectural or mechanical schedules call for ductwork to be finish painted in exposed locations, galvanized sheet metal shall be pre-etched type known as "galvaneal" or "paint-grip." Clarify with Engineer before fabrication.

D. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ANSI/ASTM A 480; AISI Type 304, with No. 4 directional polish where exposed to view in occupied spaces. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation. Where concealed, provide mill finish on sheets.

E. Aluminum Sheet: Where indicated, provide aluminum complying with ANSI/ASTM B209, Alloy 3003, Temper H14.

2.03 SHOP FABRICATED HIGH PRESSURE DUCTWORK:

A. Shop fabricate ductwork in 4, 8, 10 or 12 - foot lengths, unless otherwise indicated or required to complete runs. Fabricated to pressure standards per ASHRAE guidelines. Pre-assemble work in shop to greatest extend possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gages and reinforcement complying with SMACNA standards.

C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with centerline radius equal to 1.5 times the duct width in the plane of the turn; and fabricate to include

factory manufactured turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

D. Joints:

1. General: Longitudinal joints shall be shop or field sealed Pittsburgh or Snap-Lock Joints. Snap-lock joints are permitted in all ductwork of 144 square inch or less. Use Pittsburgh joints only on all ducts larger than 144 square inches.
2. Transverse joints shall be per SMACNA standards for pressure class. Seal in field after erection.

E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to **<Section 23 33 00><Division-15 Section>** "Ductwork Accessories" for accessory requirements.

F. Rectangular Ductwork:

1. Ductwork shall be fabricated of gages and reinforcement complying with SMACNA Standards, and shall be of sizes as shown on Drawings. Dimensions as shown are inside measurements indicating free area required. Ducts noted to receive liner shall be increased in size to maintain the inside dimensions noted.
2. Minimum rectangular duct sheet metal gauges shall be as follows:

Dimension of Longest Side	Gauge
0 - 22"	24
23 - 28"	22
29 - 36"	20
37 - 120"	18

G. Round and Flat Oval Ductwork:

1. Round and flat oval ductwork shall be factory fabricated zinc coated steel of spiral lockseam construction (longitudinal seams for ducts with 22" depth and larger).
2. Minimum round and flat oval duct sheet metal gauges for high pressure ductwork shall be as follows:

Duct Diameter or Major Axis	Gauge	Fitting Gauge
0 - 10"	28	22
11-14"	26	20
15 - 26"	24	20
27 - 36"	22	20
37 - 50"	20	18
51 - 60"	18	18
61 - 84"	16	16

H. Fittings:

1. Round and flat oval duct fittings shall be factory fabricated zinc coated steel for 45 or conical take-off from the main trunk.
2. Do not use bull head fittings.

I. Duct Configuration:

1. Ducts in chases shall have concentric offsets.
2. Ducts above ceilings (horizontal) shall have eccentric offsets to provide maximum clearances.

2.04 FACTORY-FABRICATED HIGH PRESSURE DUCTWORK:

A. General: At Installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

B. Round Ductwork:

1. Construct of galvanized sheet steel complying with ASTM A 527 by the following methods and in minimum gages listed.

Diameter	Minimum Gage	Method of Manufacturer
3 - 10"	28	Spiral Lockseam
11 - 14"	26	Spiral Lockseam
15 - 26"	24	Spiral Lockseam
27 - 36"	22	Spiral Lockseam
37 - 50"	20	Spiral Lockseam
51 - 60"	18	Longitudinal Seam
Over 60"	16	Longitudinal Seam

2. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.

C. Fittings and Couplings:

1. Construct of minimum gages listed. Provide continuous welds along seams.

Diameter	Minimum Gage
3 to 8"	22
9 to 36"	20
38 - 60"	18
Over 60"	16

D. Flat-Oval Ductwork:

1. Construct of galvanized sheet metal steel complying with ASTM A 527, of spiral lockseam construction, in minimum gages listed.

Maximum Width	Minimum Gage
Under 24"	24
25 to 48"	22
49 to 70"	20
Over 70"	18

E. Fittings and Couplings:

1. Construct of minimum gages listed. Provide continuous weld along seams.

Maximum Width	Minimum Gage

7 - 36"	20
37 to 60"	18
Over 60"	16

F. Internally Insulated Round Ductwork and Fittings:

1. Construct with outer pressure shell. 1" thick insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gages listed.

Nominal Duct Diameter	Outer Shell	Inner Liner
3 to 12"	26 ga.	26 ga.
13 to 24"	24 ga.	24 ga.
25 to 34"	22 ga.	24 ga.
35 to 48"	20 ga.	24 ga.
49 to 78"	18 ga.	22 ga.

G. Fittings and Couplings:

1. Construct of minimum gages listed. Provide continuous weld along seams of outer shell.

Nominal Duct Diameter	Outer Shell	Inner Liner
3 to 34	20 ga	20 ga.
36 to 48"	18 ga.	20 ga.
over 48"	16 ga.	20 ga.

H. Inner Liner:

1. Perforate with 3/32" holes for 22% open area. Provide metal spacers welded in position to maintain spacing and concentricity.

I. Internally Insulated Flat Oval Ductwork and Fittings:

1. Construct with outer pressure shell. 1" thick insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gages listed.

Maximum Width	Outer Shell	Inner Liner
Under 24"	24 ga.	26 ga.
25 - 48"	22 ga.	24 ga.
49 - 70"	20 ga.	22 ga.
Over 70"	18 ga.	22 ga.

2.05 MISCELLANEOUS DUCTWORK MATERIALS:

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Duct Liner Adhesive: Comply with American Society for Testing and Materials (ASTM) ASTM 916 "Specifications for Adhesives for Duct Thermal Insulation." Duct liner shall be adhered to the sheet metal and, where required, edges coated with one of the adhesives conforming to the Standard for Adhesives for Duct Liner, ASC-A-7001C-1972, of the Adhesive and Sealant Council, Inc.

C. Duct liner shall be further secured with fasteners conforming to the Mechanical Fastener Standard, MF-1-1975, on page 22 of the Duct Liner Application Standard, second edition, of the Sheet Metal and Air Conditioning Contractor's National Association.

D. Duct Sealant: Nonhardening, nonmigrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

E. Duct Cement: Nonhardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork

F. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

G. For exposed stainless steel ductwork, provide matching stainless steel support materials.

H. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

2.06 INTERNAL DUCT LINER:

A. Duct-Liner: Fibrous glass, complying with American Society for Testing Materials (ASTM) ASTM C 1071; of thickness indicated. be 1" thick composed of long textile type glass fibers firmly bonded in random orientation with a thermosetting phenolic resin minimum density of 1.5 lb/cu.ft,, thermal conductivity of 0.24 at 75 F differential, minimum sound absorption co-efficient of 0.67 at 500 Hz based upon ASTM Test Method C-423-60T,and able to withstand velocities up to 4000 feet per minute.

B. Unless otherwise indicated, the net free area of the duct dimensions given on the Drawings shall be maintained. Increase metal duct dimensions as necessary to compensate for addition of the liner.

C. The interior duct insulation shall be applied as recommended by the manufacturer including proper adhesive and adhered clips. Clip spacing shall not exceed 8" on center perpendicular to air flow and shall not exceed 12" on center in the direction of air flow.

D. All joints of the insulation shall have edges buttered with sealant, and shall be tightly buffed. Apply a brush coat of sealant at all joints on the surface of the duct liner extending at least 1" on each side of joint.

E. Provide metal nosing on all exposed edges of duct liner at fire dampers, control dampers, fan discharges, etc.

F. Liner may be adhered to the sheet metal before it is formed into ducts provided care is taken not to damage the insulation.

G. The following ductwork shall be internally lined:

1. Rectangular supply air ductwork
2. Rectangular return air ductwork
3. Relief air duct and plenums up to the suction of the fan

PART 3 - EXECUTION

3.01 GENERAL:

A. Except as otherwise noted, all main and branch trunk ducts shall be round or flat oval spiral constructed ductwork.

B. Connections between main and branch trunk ducts and high pressure mixing boxes shall be high pressure flexible duct as specified in **<Section 23 33 46><Section 15893>** “FLEXIBLE DUCTWORK”.

C. Flat oval ducts shall be reinforced by using "C" braces in the following sizes and spacing. Where oval ducts have flanged joints, the joints count as reinforcing. Additional reinforcing shall be measured from the flanges.

Flat Span Dimension (In.)	"C" Brace Size	Spacing
Below 20"	None required	
through 27"	1" x 1" x 1/8"	6'-0" O.C.
through 39"	1-1/2" x 1-1/2" x 3/16"	6'-0" O.C.
through 51"	2" x 2" x 3/16"	4'-0" O.C.
through 55"	2" x 2" x 3/16"	3'-0" O.C.
and larger	2" x 2" x 3/16"	2'-0" O.C.

D. Radius type elbows fabricated with inside radius equal to width of duct; square throat elbows with turning vanes will be permitted only where shown on Drawings or by written approval of Architect/Engineer for specific cause.

E. Wherever sound attenuators are installed in ducts, duct area shall be increased in size and be connected with manufacturer’s recommended transitions to maintain velocity.

F. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5 % leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. All ducts shall be sealed to meet SMACNA Class A classification. Both longitudinal and transverse joints and duct wall penetrations are to be sealed.

G. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth.

H. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold duct true to shape and to prevent buckling. Support ductwork in manner complying with SMACNA 1995 Second Edition, "HVAC Duct Construction Standards" hanger and supports Section.

I. Provide all necessary offsets and transformations as required in the installation of the work although same may not be specifically shown on the plans. Offset all ducts as required to increase head room under them, to improve the appearance of exposed ducts, and to avoid interference with the work of other trades.

J. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible.

K. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment.

1. Hold ducts close to walls overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.
2. Where possible, in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, furring, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate the layout with suspended ceiling and lighting layouts and similar finished work.

L. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on four sides by at least 1-1/2".

M. Where ducts pass through time-rated fire resistive construction, all openings around the ducts shall be sealed with fire stopping material.

N. Provide angle, channel, or equal type frames for all manual and automatic dampers and install as required.

O. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

3.02 INSTALLATION OF RECTANGULAR DUCTWORK:

A. Field changes in duct dimensions shall result in equivalent cross-sectional areas to dimensions shown. In no case shall the greater dimension be greater than four times the lesser.

B. All transitions shall be made with long transition fittings. Ducts shall be flared to suit shape of registers and grilles or openings for registers and grilles. Maximum angle of transition of 20 for diverging air flow and 30 for contracting air flow.

C. Changes in direction shall be made with easy flowing curves. The minimum center line radius of bends shall be at least 1-1/2 times the dimension of the duct in the plane of the turn unless otherwise shown. Radius type elbows fabricated with the inside radius equal to width of duct; short radius elbows will be permitted only by written approval of Architect/Engineer for specific cause.

D. Provide engineered air foil blades turning vanes at square elbows, minimum 2 1-1/2" wide, where shown on the drawings, and where changes in direction cannot be made as specified above. Turning vanes shall be installed inside the insulation on internally lined ducts.

E. All rectangular sheet metal ducts over 18" in width shall be cross broken or mechanically beaded to reduce vibration. Reinforcing angle and stiffeners shall be provided where required to prevent sagging, buckling, vibration, sound transmission, etc.

3.03 INSTALLATION OF ROUND AND FLAT OVAL DUCTWORK:

A. Ducts shall be assembled so that they are free of obstructions, smooth on the inside and airtight.

B. All branch takeoffs from trunk ducts shall be made with a cone shaped adapter to the trunk duct. The adapter shall be 2" more in dimension than the branch and shall taper to branch duct size with the side of the adapter not exceeding 15 degrees from the horizontal.

C. All high pressure duct shall be installed in accordance with the latest instructions of the duct manufacturer.

D. All flat oval ductwork shall be reinforced and braced in accordance with the published details of the flat oval duct manufacturer for the applicable size and pressure conditions.

3.04 JOINTS AND CONNECTIONS:

A. Joints shall be slip joints for all round and flat oval ducts having the major axis less than 40". Flat oval ducts with major axis 40" and larger shall have flanged joints.

B. All joints shall be sealed to meet SMACNA Class A classification using duct manufacturer's sealant and tape and in strict accordance with the duct manufacturer's written instructions.

3.05 FIRE DAMPERS AND COMBINATION FIRE-SMOKE DAMPERS:

A. Fire dampers and combination fire-smoke dampers shall be installed in all ducts passing through time rated fire resistive construction including but not limited to walls, floors, and shafts, whether shown or not, and elsewhere as shown on the Drawings and as required by the Indiana Building Code. All installations shall be in strict accordance with NFPA Bulletins #90A and 101 and manufacturer’s recommendations for compliance with their ratings.

B. Access sections, panels and/or doors shall be installed adjacent to each fire damper, smoke damper or combination fire-smoke damper.

3.06 LINTELS:

A. Mechanical Contractor shall be responsible for furnishing and installing lintels over all ducts that pass through load bearing walls and any duct over 12" wide, sized to support the load above. Lintel materials to be approved by the Architect/Engineer. Lintels shall be installed by craftsmen skilled in this particular trade.

3.07 TESTING:

A. All ductwork installed under this section of the specifications shall be tested in accordance with Section 20 00 42.

END OF SECTION

SECTION 23 33 00 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.02 CODE COMPLIANCE:

A. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards - Metal and Flexible".

B. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.

C. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".

D. UL Compliance: Construct, test, and label smoke dampers in accordance with UL Standard 555S “Leakage Rated Dampers for use in Smoke Control Systems”.

E. UL Compliance: Construct, test, and label combination fire-smoke dampers in accordance with UL Standard 555/UL555S

F. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

1.03 PRODUCT DATA:

A. Submittals: Submit manufacturer's technical product data, shop drawings, and maintenance data for each type of ductwork accessory.

1. Shop drawings shall include the following:

a. Fire damper or combination fire -smoke damper installations instructions and nomenclature.
b. Access door installations.
c. Volume damper, turning vanes, and extractor installation instructions, and fabrication.
d. Fire damper or combination fire-smoke damper linkage and actuator nomenclature.

B. Maintenance Manuals:

1. Provide maintenance manuals and operating instructions for fire and smoke dampers.

1.04 QUALITY ASSURANCE:

A. Reference Standard:

1. Fire dampers (HP): 1 ½ hour rated Ruskin DIBD20; 3 hour rated Ruskin DIBD 230 Style LO or LR for flat oval or round duct.

2. Multiple blade fire dampers: 1 ½ hour rated Ruskin FD60 for flat oval or round duct.
3. Fire dampers (LP): 1 ½ hour rated Ruskin DIBD20; 3 hour rated Ruskin DIBD 230 Style B for rectangular duct.
4. Smoke dampers (LP): Ruskin SD36 and SD60II for leakage class II
5. Combination fire/smoke damper 1 ½ hour rated Ruskin FSD36 and FSD60II; 3 hour rated Ruskin FSD 31,for leakage class II
6. Instrument ports: Young Regulator models 1100 and 1101
7. Access doors: United Sheet Metal type AW-1 and Air Balance model FSA-100
8. Volume dampers: Young Regulator models 301, 443, and 656
9. Turning vanes: Titus models Y and Z
10. Louvers: Construction Specialties Inc A 4157

B. Acceptable Manufacturers:

1. Instrument ports: Young Regulator
2. Access doors: Air Balance, United Sheet Metal, American Warming, National Controlled Air, Nailor Industries.
3. Volume dampers: Louvers and Dampers, Inc., Young, Titus, Greenheck, United, National Controlled Air, Air Balance, Nailor Industries.
4. Gravity Backdraft Dampers: Louvers and Dampers, Inc., Young, Titus, Greenheck, United, National Controlled Air, Air Balance, Nailor Industries.
5. Remote Damper Operators: Young Regulator, Metropolitan Air Technologies
6. Turning vanes and extractors: Titus, Krueger, National Controlled Air.
7. Fire dampers: Ruskin, Prefco, CESCO, National Controlled Air, Greenheck, United, Nailor Industries.
8. Smoke dampers: Ruskin, Prefco, CESCO, National Controlled Air, Greenheck, United.
9. Combination fire/smoke dampers: Ruskin, Prefco, CESCO, National Controlled Air, Greenheck.
10. Louvers: Ruskin, Construction Specialties, Louvers & Dampers, Inc., Greenheck, American Warming and Ventilating, Vent Products.

PART 2 - PRODUCTS

2.01 VOLUME DAMPERS:

A. Opposed blade construction reduced.
B. 5 inches by 1 inch by 16 gauge galvanized steel channel.
C. 6 inches wide 16 gauge galvanized steel blades.
D. Linkage concealed in frame.
E. Locking device to hold damper in fixed position.
F. Reference standard: Ruskin CD35.

2.02 GRAVITY BACKDRAFT DAMPERS:

A. Extruded aluminum frame .090 inch wall thickness with felt edged perimeter.
B. .025 inch formed aluminum blade with extruded vinyl edge seals.
C. Zytel bearing.
D. Counter balances adjustable for field balancing.
E. 2 inch frame.
F. Damper to be able to relieve air at pressure differentials less than .01 inch W.G.
G. Reference Standard: Ruskin CBD2.

2.03 FIRE DAMPERS:

A. 1-1/2 Hour Dynamic Fire Damper:

1. Meets UL 555 and NFPA 90A requirements for duct penetrations of fire rated walls, partitions, and floors with fire resistance ratings of less than 3 hours.
2. 20 gauge galvanized steel channel.
3. 24 gauge galvanized steel bladed curtain.
4. 165 degrees fusible link.
5. Suitable for vertical or horizontal mounting.
6. Fire damper blades shall be out of the air stream so that duct size is maintained.
7. Damper shall be provided with an integral steel sleeve suitable for the substrate into which it is to be installed. Provide integral “picture frame” mounting angles

B. 1 1/2 Hour Dynamic Multiple Blade Fire Damper:

1. These dampers are to be used in lieu of Style LO or LR for flat oval or round duct when duct size is such that the largest single section UL listed LO or LR damper is exceeded.
2. Meets UL 555 and NFPA 90A requirements for duct penetrations of fire rated walls, partitions, and floors with fire resistance ratings of less than 3 hours.
3. 20 gauge galvanized steel channel.
4. 24 gauge galvanized steel bladed curtain.
5. 165 degrees fusible link.
6. Suitable for vertical or horizontal mounting.
7. Fire damper blades shall be opposed blade airfoil type.
8. Damper shall be provided with an integral steel sleeve suitable for the substrate into which it is to be installed. Provide integral “picture frame” mounting angles

C. 3 Hour Dynamic Fire Damper:

1. Meets UL 555 and NFPA 90A requirements for duct penetrations of fire rated walls, partitions, and floors with fire resistance ratings of 3 hours or more.
2. 18 gauge galvanized steel channel.
3. 22 gauge galvanized steel bladed curtain.
4. 165 degrees fusible link.
5. Suitable for vertical and horizontal mounting.
6. Fire damper blades shall be out of the air stream so that duct size is maintained.
7. Damper shall be provided with an integral steel sleeve suitable for the substrate into which it is to be installed. Provide integral “picture frame” mounting angles

2.04 DUCT ACCESS DOORS:

A. Low Pressure Rectangular Ductwork

1. UL listed.
2. One inch thick insulated 22 gauge galvanized steel door.
3. 22 gauge galvanized steel frame having 5/8 inch knock over edges.
4. Continuous aluminum hinge.
5. Cam lock latch.
6. 1/2 inch wide gasket.
7. Square opening; minimum 12”x12”.

B. Round or Flat Oval High or Low Pressure Ductwork:

1. Assembly shall be a complete duct section access door combination.

2. Minimum 20 gauge galvanized steel welded construction.
3. Access section shall have same diameter as duct in which they are installed.
4. Shall have pressure sensitive release for manual or emergency vacuum release.
5. Double wall galvanized steel insulated door having handle, chain retainer and gasket.

2.05 TURNING VANES:

A. Duct turning vanes shall be dual radius type secured to steel side pieces, length as required for duct size; constructed in accordance with SMACNA Standards Plate 22 (Low Velocity).

2.06 FLEXIBLE CONNECTIONS:

A. Flexible duct connections shall be UL listed neoprene coated double glass fabric; connections exposed to weather or other moisture conditions shall have a rubber exterior finish.

2.07 INSTRUMENT PORTS:

A. Instrument ports shall be die cast collar cap; neoprene gasket, raised base to depth of insulation.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All ductwork accessories shall be fabricated and installed in accordance with the recommendation of the latest edition of ASHRAE Handbooks and SMACNA Duct Construction Standards.

B. Accessories:

1. Volume dampers shall be installed at each branch duct connection to main or trunk duct; where shown on the Drawings; and elsewhere as required to provide for proper air distribution and balancing.
2. Fire dampers and combination fire-smoke dampers shall be installed in all ducts passing through time rated fire resistive construction including but not limited to walls, floors, and shafts, whether shown or not, and elsewhere as shown on the Drawings and as required by the Indiana Building Code. All installations shall be in strict accordance with NFPA Bulletins #90A and 101 and manufacturer's recommendations for compliance with their ratings.
3. Flexible connections shall be provided for every duct connection to equipment and as elsewhere shown on the Drawings. Connection shall be of sufficient length to eliminate vibration transmission.
4. Access doors shall be provided in ducts downstream from fire dampers for access to fire damper operating mechanisms. Access doors shall open inward and serve as pressure release in the event of fire damper closure.
5. Access doors shall be provided in ducts and plenums at all motorized and/or control dampers.
6. Instrument ports shall be provided on both the inlet and discharge side of air supply fans and elsewhere as shown on the Drawings.
7. Backdraft dampers shall be installed below each exhaust fan and relief vent at roof in a position accessible from the roof.

8. Turning vanes shall be installed in each supply duct at 90 elbows and elsewhere shown on the Drawings. Field fabricated turning vanes are not acceptable.
9. Install concealed damper regulators with flush cover plates on dampers serving animal rooms.

END OF SECTION

SECTION 22 33 46 - FLEXIBLE DUCTWORK

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.02 WORK DESCRIPTION:

A. Furnish and install flexible duct connections of the size as shown or implied on the Contract Documents.

B. Extent of the work is indicated on the Drawings and in the schedules, and by requirements of this section.

1.03 QUALITY ASSURANCE:

A. The flexible duct shall have been tested by UL under Standard UL #181 and shall be listed as a "Flexible Air Duct Connector," Class I

B. Construction Standards:

1. All ducts shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards”.
2. Where SMACNA standards provide no guidance, comply with ASHRAE Handbook of Fundamentals chapter on Duct Construction.
3. Comply with ANSI/NFPA 90A “Standard for the Installation of Air-Conditioning and Ventilating Systems” and ANSI/NFPA 90B “Standard for the Installation of Warm Air Heating and Air-Conditioning Systems”.

1.04 SUBMITTALS:

A. Submit descriptive literature and shop drawings for manufactured products and factory fabricated flexible ductwork in accordance with Division 1 requirements.

B. Complete dimensioned layouts of ductwork are required for sheetmetal ductwork. Indicate location of all flexible duct and fan connections.

C. Indicate hanging and support details for flexible ductwork.

1.05 RECORD DRAWINGS:

A. Submit Record Drawings in accordance with Division 1 requirements.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Protect flexible ductwork, accessories and purchased products from damage, dirt, and moisture during shipment, storage, and handling.

B. Where possible, store flexible ductwork inside and protect from the weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Clevaflex
B. Wiremold
C. Flexmaster
D. Thermaflex
E. Norflex
F. Atco
G. Hart and Cooley

2.02 FLEXIBLE DUCT:

A. Insulated, flexible ductwork shall be constructed having two tough plies of black polyester film encapsulating a galvanized steel helix. The covering shall be one inch thick fiberglass of 3/4 lb. density, with an airtight PVC skin serving as a vapor barrier.

B. Insulated, low pressure flexible ductwork shall be used to connect supply duct, terminal units with the air distribution devices Low pressure flexible duct shall be suitable for 6” w.c. positive working pressure.

C. Insulated high pressure flexible ductwork shall be used to connect high pressure supply air duct to the inlet side of air volume control boxes. High pressure flexible duct shall be rated for 10” w.c. positive working pressure.

2.03 FLEXIBLE CONNECTIONS

A. Provide flexible fabric connections at suction and discharge connections of sheet metal ductwork with supply and exhaust fans, and other equipment employing such fans.

B. Provide flexible fabric connections at suction and discharge connections of concealed cabinet heaters, fan coil units, heat pumps, etc., and as otherwise noted on the Drawings.

C. Fabricate of 30 oz. "Ventglas," or equal, neoprene coated fabric properly secured by bolted angles or band iron. No metal to metal contact will be allowed.

D. Flexible connection fabric shall be approved by the Underwriter's Laboratories, Inc., and comply with UL-191-1967.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Provide flexible duct where and noted on the Drawings. Lengths of flexible duct shall not exceed 6 feet and shall be continuously supported. Duct shall be supported from above at not to exceed 3'-0" o.c. and shall not lie on ceiling or light fixtures. Support flexible duct from integral grommet strip or minimum 1" sheetmetal bands per SMACNA figure 3-10.

B. Ducts shall be installed in one continuous piece with no intermediate joints.

C. Not more than 2 elbows shall be formed from flexible duct. Form additional elbows out of hard pipe. Install flexible duct connections.

D. Connections at ductwork and terminals shall be air tight. Spin-in fittings may be used when connecting to rectangular ducts.

E. When installing, insulation shall be pulled back and the core shall be securely taped with three wraps of pressure sensitive tape, and then banded with a corrosive resistant metal band. After banding, insulation and vapor barrier shall be replaced, taped, and sealed around duct connection.

F. For low pressure duct connections, slip the flexduct over the collar and sheet metal screw through the duct and collar. Seal the joint with duct tape and an aluminum drawband.

G. Do not pass through walls with flexible duct.

H. Provide the flexible connections at ductwork connection to vibrating or rotating equipment, including fans.

END OF SECTION

SECTION 23 34 23 - EXHAUST FANS

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK:

A. The Contractor shall furnish all the labor, materials, equipment, appliances, services and drayage, and perform all the operations in connection with the construction and installation of the Work. All Work to be as herein specified and as denoted on the accompanying Drawings.

B. This Section of the Work includes the furnishing and installation of the in-line suspended exhaust ventilators and roof-mounted powered exhaust ventilators, complete with associated ductwork, dampers, etc., as herein specified and/or indicated on the Drawings.

1.03 QUALITY ASSURANCE:

A. Units shall be licensed to bear the Air Moving and Conditioning Association, Inc. AMCA) seal for air moving performance shall be tested in accordance with AMCA Standard 210.

B. Some ratings listed for specific performances shall be in accordance with methods outlined in AMCA Bulletin 301.

C. UL Compliance - Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

D. NEMA Compliance - Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard - Components and installation shall comply with NFPA 70 "National Electrical Code."

F. Manufacturers: Subject to compliance with requirements provide exhaust fans of one of the following manufacturers

1. Greenheck Fan Corp.
2. Penn Ventilator
3. Loren-Cook Co.
4. Carnes
5. Twin City Fan & Blower
6. Barry Blower

1.04 SUBMITTALS:

A. General - Submit the following in accordance with the requirements of Division 1.

1. Product Data - for selected models, including specialties, accessories, and the following:

a. Certified fan performance curves with system operating conditions indicated.
b. Certified fan sound power ratings.
c. Motor ratings and electrical characteristics plus motor and fan accessories.
d. Materials gauges and finishes, including color charts.
e. Dampers, including housings, linkages, and operators.

PART 2 - PRODUCTS

2.01 DIRECT DRIVE CEILING EXHAUST FANS:

A. Direct driven ceiling exhaust fans shall be the centrifugal blower type with fan housing constructed of injection molded resin. The fan inlet box shall be min 22 gage galvanized steel. Unit shall be constructed so that removal of several fasteners shall allow for removal of entire power assembly and wheel for servicing and cleaning.

1. The motor shall be mounted on vibration isolators and shall be completely sealed from the exhausted air and fumes. The motor cooling air shall be taken into the chamber from a location free of discharge contaminants.
2. Fans shall have the capacity, speeds, and motor sizes and electrical characteristics as scheduled on the Drawings.
3. Provide an integral UL approved safety disconnect receptacle as recommended by the manufacturer for all units.
4. White , non-yellowing high-impact injection molded styrene grille

PART 3 - EXECUTION

3.01 Provide spring type isolators sized to match the weight of each individual fan. Brackets shall be furnished with the units for hanging from structure above.

3.02 Check all units for proper performance, fan and/or motor rotation, and adjust as required.

3.03 Refer to Section 20 01 90 for proper identification tagging of equipment.

END OF SECTION

SECTION 23 36 01 - FAN-POWERED VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.02 WORK DESCRIPTION:

A. Scope of Work:

1. Furnish and install variable air volume terminal equipment as shown and/or scheduled on the Contract Documents.

2. Electrical service to units shall be provided as specified under Division 26 Sections.

B. Products Included:

1. Fan-powered variable air volume terminal units.
2. Fan-powered variable air volume terminal units with reheat coils.

1.03 QUALITY ASSURANCE:

A. Reference Standards:

1. ARI 880: Industry Standards for Air Terminals
2. Coil capacities shall be ARI certified and labeled.
3. Sound ratings shall be in accordance with ARI Standard 880-94.
4. Unit leakage ratings shall be in accordance with current ADC Test Code 1062R4.

1.04 SUBMITTALS:

A. Submit descriptive product literature and shop drawings in accordance with requirements of Division 1.

1. Submittals and shop drawings shall include the following data:

a. Performance curves
b. Capacity certification
c. Wiring diagrams
d. Unit dimensions
e. Accessories furnished
f. Installation methods
g. Sound ratings for octave bands 1 through 8 at the units proposed operating conditions.

2. Submit a schedule of units which includes the following data for each unit:

a. Unit designation
b. Room location
c. Model number
d. Unit size and configuration
e. Accessories furnished

B. Submit maintenance manuals in accordance with requirements of Division 1.

1. Maintenance manuals shall include the following:

a. Parts lists for each type of terminal unit
b. Published installation instructions.
c. Troubleshooting maintenance guide for each type of unit.

PART 2 - PRODUCTS

2.01 FAN-POWERED VARIABLE AIR VOLUME TERMINAL UNITS:

A. General:

1. Configurations:

a. Units shall be provided of parallel configuration with intermittent fan operation or series configuration with constant fan operation as indicated on the Mechanical Contract Drawings.

b. Units shall be available in right or left-hand configurations as indicated on the Mechanical Contract Drawings.

2. Terminal units shall be completely assembled and tested at the factory prior to shipment and shall bear the UL label of approval.

B. Unit Construction:

1. Cabinets shall be constructed of minimum 22 gauge galvanized steel, lined with 1/2" thick, minimum 1.5 lb/cu.ft. density thermal/acoustical insulation which complies with NFPA 90A and UL 181.

2. Interior liners:

a. Insulation shall be lined with scrim backed aluminum foil facing. All insulation surfaces shall be covered with foil or metal nosing. Unit construction shall meet bacteriological standard ASTM C 665.

3. An access door shall be provided in the bottom of the unit for easy servicing and removal of the fan without disturbing the ductwork connections.

4. Cabinets shall be constructed to maintain leakage less than 1% of rated capacity at rated inlet static pressure.

C. Fan Assembly:

1. Provide forward-curved style dynamically balanced fan wheels. Fan and motor shall be internally isolated from housing using either torsion-flex suspension or rubber isolators.

2. Fan motor assembly shall be forward curved centrifugal fan with a direct drive motor. Motors shall be General Electric ECM variable-speed dc brushless motors specifically designed for use with single phase, 277 volt, 60 hertz electrical input. Motor shall be complete and operated by a single phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. All motors shall be designed for synchronous rotation. Rotor shall be permanent magnet type with near zero rotor losses.

Motor shall have built-in soft start and soft speed change ramps. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motor shall be directly coupled to the blower. Motor shall maintain a minimum of 70 percent efficiency over its entire operating range. Provide a motor that is designed to overcome reverse rotation and not affect life expectancy.

3. The terminal unit manufacturer shall provide a factory installed PWM controller for either manual or DDC controlled fan cfm adjustment. The manual PWM controller shall be field adjustable with a standard screwdriver. The remote PWM controller shall be capable of receiving a 0-10 Vdc signal from the DDC controller (provided by the controls contractor) to control the fan cfm. When the manual PWM controller is used, the factory shall preset the fan cfms as shown on the schedule.

D. Air Valve/Damper Assemblies:

1. Air valve/damper assemblies shall be constructed of galvanized steel or anodized aluminum components. Mechanical dampers with externally mounted actuators or air valves with integral actuators are acceptable. Air valve/damper assemblies shall fail to the open position.

a. Each damper blade shall be mechanically fastened to the shaft for permanent damper blade position. All damper pivot points shall be fitted with self-lubricating bearings. Nylon bearings are not acceptable. The damper shall incorporate mechanical stops for full open and closed positions to prevent stroking beyond 90°. Damper blade seals shall be mechanically secured to the blades. Damper shafts shall be clearly marked at each end so that position is visible from exterior of unit.

b. Differential pressure measurement in inlet of each terminal shall utilize multi-point averaging type velocity sensors of either flow ring or twin perpendicular cross configuration with center averaging chamber. Integral flow measurement taps shall be provided with an airflow calibration chart which indicates the CFM vs. velocity performance curve. Chart shall be fastened to exterior of unit to facilitate balancing.

c. Damper operators shall be integral or externally mounted. Actuators for blade type dampers shall be capable of a minimum 35 in. lbs. of torque.

2. Air valves shall be constructed to prevent air leakage in excess of 1% of rated air quantity at rated inlet static pressures.

E. Air Filters:

1. Terminal units shall include a filter rack on the plenum inlet suitable for filter removal without the use of tools. Filters shall be sized for a maximum of 600 FPM air velocity. Provide 1” thick disposable fiberglass filters.

F. Connections:

1. Inlet collar shall be suitable for flexible duct connection.

2. Unit discharge shall be suitable for slip and drive ductwork connection.

3. Single point electrical connection:

a. All electrical components shall be located in a NEMA 1 enclosure, including control transformers.

b. Factory mounted external disconnect switch shall be provided on all units.

G. Temperature Controls:

1. DDC:

a. Terminal unit manufacturer shall provide velocity sensor and damper actuator. Unit shall come equipped with a factory mounted NEMA 1 control enclosure to house all DDC control devices and/or control transformers.

b. Temperature Control Contractor shall furnish terminal unit transducer/controller and control transformer to terminal unit manufacturer for factory mounting and wiring. Mounting and wiring costs shall be borne by the terminal unit manufacturer. Field mounting of control devices will not be accepted.

c. Calibrate and set minimum and maximum settings at the factory. Calibration to be field verified and reset by Test & Balance Contractor if required.

H. Performance:

1. Sound ratings for the unit shall not exceed the NC sound values listed in the equipment schedule on the Mechanical Contract Drawings, without credit for duct or room attenuation. Unit sound performance shall be ARI certified and shall be measured in accordance with ASHRAE Standard 36B-63.

2. Differential static pressure drop through each terminal unit shall not exceed value listed in the equipment schedule on the Mechanical Contract Drawings.

I. Acceptable Manufacturers:

1. Price
2. Enviro-Tec
3. Titus
4. Trane

2.02 FAN-POWERED VARIABLE AIR VOLUME TERMINAL UNITS WITH REHEAT COILS:

A. General:

1. Configurations:

a. Units shall be provided of parallel configuration with intermittent fan operation or series configuration with constant fan operation as indicated on the Mechanical Contract Drawings.

b. Units shall be available in right or left-hand configurations as indicated on the Mechanical Contract Drawings.

2. Terminal units shall be completely assembled and tested at the factory prior to shipment and shall bear the UL label of approval. Terminal units with electric

reheat coils shall also bear the ETL label of approval as completely packaged unit.

B. Unit Construction:

1. Cabinets shall be constructed of minimum 22 gauge galvanized steel, lined with 1/2" thick, minimum 1.5 lb/cu.ft. density thermal/acoustical insulation which complies with NFPA 90A and UL 181.

2. Interior liners:

a. Insulation shall be lined with scrim backed aluminum foil facing. All insulation surfaces shall be covered with foil or metal nosing. Unit construction shall meet bacteriological standard ASTM C 665.

3. An access door shall be provided in the bottom of the unit for easy servicing and removal of the fan without disturbing the ductwork connections.

4. Cabinets shall be constructed to maintain leakage less than 1% of rated capacity at rated inlet static pressure.

C. Fan Assembly:

1. Provide forward-curved style dynamically balanced fan wheels. Fan and motor shall be internally isolated from housing using either torsion-flex suspension or rubber isolators.

2. Fan motor assembly shall be forward curved centrifugal fan with a direct drive motor. Motors shall be General Electric ECM variable-speed dc brushless motors specifically designed for use with single phase, 277 volt, 60 hertz electrical input. Motor shall be complete and operated by a single phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. All motors shall be designed for synchronous rotation. Rotor shall be permanent magnet type with near zero rotor losses. Motor shall have built-in soft start and soft speed change ramps. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motor shall be directly coupled to the blower. Motor shall maintain a minimum of 70 percent efficiency over its entire operating range. Provide a motor that is designed to overcome reverse rotation and not affect life expectancy.

3. The terminal unit manufacturer shall provide a factory installed PWM controller for either manual or DDC controlled fan cfm adjustment. The manual PWM controller shall be field adjustable with a standard screwdriver. The remote PWM controller shall be capable of receiving a 0-10 Vdc signal from the DDC controller (provided by the controls contractor) to control the fan cfm. When the manual PWM controller is used, the factory shall preset the fan cfms as shown on the schedule.

4. Terminal units exceeding 1500 CFM shall have multiple fans driven by independent motors.

D. Air Valve/Damper Assemblies:

1. Air valve/damper assemblies shall be constructed of galvanized steel or anodized aluminum components. Mechanical dampers with externally mounted

actuators or air valves with integral actuators are acceptable. Air valve/damper assemblies shall fail to the open position.

a. Each damper blade shall be mechanically fastened to the shaft for permanent damper blade position. All damper pivot points shall be fitted with self-lubricating bearings. Nylon bearings are not acceptable. The damper shall incorporate mechanical stops for full open and closed positions to prevent stroking beyond 90°. Damper blade seals shall be mechanically secured to the blades. Damper shafts shall be clearly marked at each end so that position is visible from exterior of unit.

b. Differential pressure measurement in inlet of each terminal shall utilize multi-point averaging type velocity sensors of either flow ring or twin perpendicular cross configuration with center averaging chamber. Integral flow measurement taps shall be provided with an airflow calibration chart which indicates the CFM vs. velocity performance curve. Chart shall be fastened to exterior of unit to facilitate balancing.

c. Damper operators shall be integral or externally mounted. Actuators for blade type dampers shall be capable of a minimum 35 in. lbs. of torque.

2. Air valves shall be constructed to prevent air leakage in excess of 1% of rated air quantity at rated inlet static pressures.

E. Reheat Coils:

1. Electric Coils:

a. Electric coils shall be supplied and installed on the terminal by the terminal manufacturer. Coil shall be integral with the terminal. Elements shall be 80/20 nickel chrome, supported by ceramic isolators a maximum of 3½ inches apart, staggered for maximum thermal transfer and element life, and balanced to ensure equal output per step. The integral control panel shall be housed in a NEMA 1 enclosure, with hinged access door for access to all controls and safety devices.Heater shall include a factory mounted and wired hinged control panel containing magnetic or mercury contactors as required. Heaters shall be furnished with high temperature thermal cutouts, airflow proving switch, line fusing, and all controls necessary for safe operation and full compliance with National Electrical Code requirements. Provide complete wiring diagram inside panel of control enclosure indicating power requirements and kW output.

b. Electric coils shall contain a primary automatic reset thermal cutout, a secondary replaceable heat limiter per element, differential pressure airflow switch for proof of flow, and line terminal block. Coil shall include an integral door interlock type disconnect switch, which will not allow the access door to be opened while power is on. Non-interlocking type disconnects are not acceptable. All individual components shall be UL listed or recognized.

F. Air Filters:

1. Terminal units shall include a filter rack on the plenum inlet suitable for filter removal without the use of tools. Filters shall be sized for a maximum of 600 FPM air velocity. Provide 1” thick disposable fiberglass filters.

G. Connections:

1. Inlet collar shall be suitable for flexible duct connection.

2. Unit discharge shall be suitable for slip and drive ductwork connection.

3. Single point electrical connection:

a. Unit shall be provided with a line terminal block located in a NEMA 1 enclosure for easy field connection.

b. Factory mounted external disconnect switch shall be provided on all units.

H. Temperature Controls:

1. DDC:

a. Terminal unit manufacturer shall provide velocity sensor and damper actuator. Unit shall come equipped with a factory mounted NEMA 1 control enclosure to house all DDC control devices and/or control transformers.

b. Temperature Control Contractor shall furnish terminal unit transducer/controller and control transformer to terminal unit manufacturer for factory mounting and wiring. Mounting and wiring costs shall be borne by the terminal unit manufacturer. Field mounting of control devices will not be accepted.

c. Calibrate and set minimum and maximum settings at the factory. Calibration to be field verified and reset by Test & Balance Contractor if required.

I. Performance:

1. Sound ratings for the unit shall not exceed the NC sound values listed in the equipment schedule on the Mechanical Contract Drawings, without credit for duct or room attenuation. Unit sound performance shall be ARI certified and shall be measured in accordance with ASHRAE Standard 36B-63.

2. Differential static pressure drop through each terminal unit shall not exceed value listed in the equipment schedule on the Mechanical Contract Drawings.

J. Acceptable Manufacturers:

1. Anemostat
2. Enviro-Tec
3. Tempmaster
4. Titus
5. Trane

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Terminal units shall be installed per manufacturer’s written recommendations.

B. Units shall be suspended from structure using 1/4" all thread hanger rods with rubber isolators. Support each unit from all 4 corners of the cabinet. Provide canvas flexible duct connection on the discharge of fan-powered terminal units.

C. Position terminal units with electric reheat coils such that a minimum of 36” access clearance is available at electrical enclosure.

D. Provide a minimum of two duct diameters of straight ductwork at each terminal unit inlet. This requirement overrides the diagrammatic representation of the Mechanical Contract Drawings.

3.02 ADDITIONAL EQUIPMENT:

A. Install temporary filters during construction and prior to unit startup. Replace temporary filters with permanent filters just prior to balancing of system. Provide owner with one complete set of clean, spare filters at completion of project.

END OF SECTION

SECTION 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.01 RELATED SECTIONS:

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 20 Specification Sections, apply to work of this Section.

1.01 WORK DESCRIPTION:

A. Furnish and install air distribution devices as shown and/or scheduled on the Contract Documents.

B. Products Included (Reference Schedules on Mechanical Contract Drawings):

1. Type “EG” - Exhaust Grilles
2. Type “RG” - Return Grilles
3. Type “SD” - Supply Diffusers
4. Type “SG” - Supply Grilles

1.02 QUALITY ASSURANCE:

A. Reference Standards:

1. ADC Compliance: Test and rate registers, grilles, and diffusers in accordance with ADC Equipment Test Code 1062, provide Certified Ratings Seal on each unit.
2. ARI Compliance: Test and rate registers, grilles, and diffusers in accordance with ARI Standard 650.
3. NFPA Compliance: Construct and install air outlets and inlets in accordance with NFPA 90A-93.
4. Diffuser, register, and grilles finishes must meet the requirements of ASTM 870 Water Immersion Test, ASTM D117 Corrosive Environments Salt Spray Test, and ASTM D-2794 Reverse Impact Cracking Test under 50 in-lb.

1.03 SUBMITTALS:

A. Submit descriptive product literature and shop drawings in accordance with requirements of Division 1.

1. Submittals and shop drawings shall include the following:

a. Dimensions
b. Materials of construction
c. Finish
d. Performance data

1) Throw and drop
2) Static-pressure drop
3) Noise ratings

e. Accessories furnished
f. Mounting details

PART 2 - PRODUCTS

2.01 STEEL EXHAUST GRILLES “EG”:

A. Capacity, size, and pattern as noted on the Mechanical Contract Drawings.

B. All steel construction.

C. White, baked enamel finish.

D. Maximum sound level NC-35.

E. 35° or 45° fixed deflection blades spaced ¾" on center, blades parallel to long dimension.

F. 1-1/4” frame mounting with countersunk screwholes.

G. Manufacturers:

1. Nailor Industries 6145H
2. Krueger 80H
3. Price 530/F/L/A
4. Titus 350RL

2.02 SUPPLY DIFFUSERS “SD”:

A. Capacity, size, and pattern as noted on the Mechanical Contract Drawings.

B. 24 gauge stamped steel construction.

C. White, baked enamel finish.

D. Maximum sound level NC-25.

E. 24”x24” Panel style face with three square cones.

F. Mounting suitable for lay-in acoustical ceiling.

G. Manufacturers:

1. Nailor Industries RNS
2. Price SCD
3. Titus TMS

2.03 RETURN GRILLES “RG”:

A. Capacity and size as noted on the Mechanical Contract Drawings.

B. All aluminum construction.

C. White, baked enamel finish.

D. Aluminum perimeter frame with ½” X ½” X ½” aluminum core.

E. Mounting suitable for lay-in acoustical ceiling.

F. 1-1/4” frame mounting with countersunk screwholes for gypsum board ceilings.

G. Manufacturers:

1. Nailor Industries 51EC
2. Price 80/F/A
3. Titus 50F

2.04 SUPPLY GRILLES “SG”:

A. Capacity, size, and pattern as noted on the Mechanical Contract Drawings.

B. All steel construction.

C. White, baked enamel finish.

D. Maximum sound level NC-25.

E. Double deflection blades spaced ¾” on center, front blades parallel with long dimension.

F. Blades shall be individually adjustable with friction pivot points at each end.

G. 1-1/4” frame mounting with countersunk screwholes.

H. Manufacturers:

1. Anemostat S2HO
2. Carnes RTDA
3. Krueger 880H
4. Metal-Aire V4004S
5. Nailor Industries 61DHO
6. Price 520/F/L/A
7. Titus 300RL

2.05 ACCESSORIES:

A. Provide standard manufacturer’s plaster frames for all diffusers, registers, and grilles located in gypsum or plaster ceilings.

B. Provide dampers with fusible links for all diffusers, registers, and grilles located in fire rated ceilings. **(Elevator equipment rooms especially)**

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Diffusers, registers, and grilles shall be installed per manufacturer’s written recommendations.

B. Secure all devices snug to ceiling. Support registers and grilles centered within acoustical ceiling tile from T-bars (not from pads), using horizontal channels secured to duct and T-bars.

C. Install plaster type frames and wall mounted devices tight to walls.

D. Diffuser, register, and grille locations as shown on the Drawings are approximate. Installation shall be in accordance with Architect's/Engineer's reflected ceiling plan.

E. All duct connections to supply, return, exhaust and relief outlets shall be banded and taped.

Provide tamperproof fasteners in all security type installations.

END OF SECTION

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.
6. Electrical Demolition
7. Cutting and patching for electrical construction.

1.03 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

A. Product Data: For sleeve seals.

B. Wire, Conduit and Cable.

C. Fuses, Disconnects and Switches

1.05 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.

4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

A. Description: Sleeve to penetrate through exterior wall below grade.

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

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.

2. Sleeves: Sleeves shall be molded non-metallic, non-corrosive, high density polyethylene and formed to have a water stop and anchor plate at least 4” larger than the outside diameter of the sleeve itself. End caps with nailing flanges shall be provided on each end to facilitate attaching the sleeve to the wall form and to prevent deformation during the initial concrete pour. End caps shall remain in place to protect the opening from foreign debris and rodent entry until it is penetrated by the pipe, tubing, or cable.

3. Application Chart
   a. 3/4” conduit – Pipeline Seal Inc Century Line CS-3-length, or equal.
   b. 1” conduit – Pipeline Seal Inc Century Line CS-3-length, or equal.
   c. 1 1/4” conduit – Pipeline Seal Inc Century Line CS-3-length, or equal.
   d. 1 1/2” conduit – Pipeline Seal Inc Century Line CS-3-1/2-length, or equal.
   e. 2” conduit – Pipeline Seal Inc Century Line CS-4-length, or equal.
   f. 2 1/2” conduit – Pipeline Seal Inc Century Line CS-4-length, or equal.
   g. 3” conduit – Pipeline Seal Inc Century Line CS-5-length, or equal.
   h. 3 1/2” conduit – Pipeline Seal Inc Century Line CS-6-length, or equal.
   i. 4” conduit – Pipeline Seal Inc Century Line CS-6-length, or equal.

B. Description – Rectangular sleeves to penetrate exterior wall above grade

1. Sleeves: Galvanized sheet steel.

2. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.

2.02 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.
e. Thunderline/Link Seal

2. Sealing Device: Closures shall be of the modular, mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal shall be constructed so as to provide electrical insulation between the pipe and wall, thus reducing cathodic reaction between these two members. Seals shall be Type S316 with 316 stainless steel nuts, bolts and washers and non-metallic pressure plates.

3. Application Chart
a. 3/4” conduit – Pipeline Seal Inc Link-Seal LS-315-S316- 4 links, or equal.
b. 1” conduit – Pipeline Seal Inc Link-Seal LS-300-S316-4 links, or equal.
c. 1 1/4” conduit – Pipeline Seal Inc Link-Seal LS-275-S316-7 links, or equal.
d. 1 1/2” conduit – Pipeline Seal Inc Link-Seal LS-300-S316-5 links, or equal.
e. 2” conduit – Pipeline Seal Inc Link-Seal LS-300-S316-6 links, or equal.
f. 2 1/2” conduit – Pipeline Seal Inc Link-Seal LS-200-S316-9 links, or equal.
g. 3” conduit – Pipeline Seal Inc Link-Seal LS-315-S316-9 links, or equal.
h. 3 1/2” conduit – Pipeline Seal Inc Link Seal LS-340-S316-10 links, or equal.
i. 4” conduit – Pipeline Seal Inc Link-Seal LS-300-S316-10 links, or equal.

2.03 GROUT

A. 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.

2.04 TOUCHUP PAINT

A. For equipment: Equipment manufacturer’s paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors **2 inches** above finished floor level.

G. Size pipe sleeves per Specifications to provide annular clear space for link seals.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for installation of sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install pipe sleeves. Size sleeves to allow for installation of sleeve seal.

3.03 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.05 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.06 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

END OF SECTION 260500

SECTION 260510 - ELECTRICAL TESTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes general requirements for electrical field testing and inspecting. Detailed requirements are specified in each Section containing components that require testing. General requirements include the following:

1. Qualifications of testing agencies and their personnel.

2. Suitability of test equipment.

3. Calibration of test instruments.

4. Coordination requirements for testing and inspecting.

5. Reporting requirements for testing and inspecting.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications: As specified in each Section containing electrical testing requirements and in subparagraph and associated subparagraph below.

B. ANSI (American National Standards Institute)

1. ANSI/IEEE 95

2. ANSI/IEEE 400

3. ANSI/IEEE C57.12.11

C. IEEE (Institute of Electrical and Electronic Engineers)

1. IEEE 48

2. IEEE 81 - Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Earth

3. IEEE 141

D. NEMA (National Electrical Manufacturers Association)

E. NETA (National Electrical Testing Association)

1. Test Equipment Suitability: Comply with NETA ATS, Section 5.2.

2. Test Equipment Calibration: Comply with NETA ATS, Section 5.3.

3. NETA 1.001 Standards for Acceptance Testing of Electrical Distribution Apparatus

PART 2 - NOT USED

PART 3 - EXECUTION

3.01 GENERAL TESTS AND INSPECTIONS

A. This specification provides guidelines for the inspection, testing, and checkout of the electrical system to ensure that the electrical installation is in accordance with the design specifications, drawings, and Manufacturers Instructions.

B. The listings and descriptions of the inspections, tests and checks described herein shall not be considered an all inclusive. Additional normal standard construction (and sometimes repetitive) checks and tests may be necessary throughout the job.

C. Inspections and test work shall be coordinated with the Owner/Architect/Engineer representative. Reasonable notice shall be given to Owner/Architect/Engineer to allow witnessing for those tests designated to be witnessed.

D. Where indicated, the tests shall be performed by an independent testing agency with the following qualifications:

1. Testing firm shall be corporately and financially independent testing organizations which can function as an unbiased testing authority, professionally independent of the manufacturer, supplier, and installer of equipment or system evaluated by the testing firm.

2. Testing firm shall be regularly engaged in testing of electrical equipment, devices, installations and systems.

3. Testing laboratory shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 29, part 1907.

4. Lead, on site technical person shall be currently certified by the National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

5. Testing firm shall use technicians who are regularly employed by firm for testing services.

6. Testing firm shall submit proof of above qualifications with reports and bid documents when requested.

E. If a group of tests are specified to be performed by an independent testing agency, prepare systems, equipment, and components for tests and inspections, and perform preliminary tests to ensure that systems, equipment, and components are ready for independent agency testing. Include the following minimum preparations as appropriate:

1. Perform insulation-resistance tests.

2. Perform continuity tests.

3. Provide a stable source of single-phase, 208/120-V electrical power for test instrumentation at each test location.

F. Equipment and circuitry shall not be energized, de-energized, or tied-in to a system without prior review and approval or the test plan and procedure by the site electrical superintendent and the owner's representative.

G. The checks and tests shall be documented on Quality Control Forms or similar forms approved for the project.

H. The Electrical Contractor Project Manager shall be responsible for all inspection and test activities. The detail implementation plan must be reviewed and approved by the Engineer of Record.

I. Inspector and test technicians shall be qualified for the work by virtue of training and experience.

3.02 TESTING AND INSPECTION OF EQUIPEMENT AND CABLE

A. Preparation

1. A detail plan and schedule shall be prepared for inspection and testing activities.

2. The testing and checkout of important electrical equipment such and switchgear, substations, drive equipment, motor load/control centers, and generators may require notification of the proposed check's to the equipment manufacturer's representative.

a. It is important that equipment warranties or guarantees shall not be voided by testing and checkout work.

b. The checks and tests shall normally be supplemental to and compatible with the manufactures' instruction leaflets or literature.

c. Where deviations are apparent, the manufacturers' review shall be obtained before testing.

d. Reasonable cooperation shall be extended to permit witnessing by the manufacturer's representative if so required.

e. Where any questionable repairs, modifications, significant adjustments, tests, or checks are to be made, the test supervisor shall contact the electrical superintendent to determine if the work should be performed by or with the manufacturer's representative.

f. Serial and model number of the instruments used, along with the last calibration date, shall be recorded on the test form.

3. Testing and checkout work shall be preformed with fully qualified personnel skilled in the particular test being conducted. This is essential for obtaining and properly evaluating data while the tests are in progress, and that important facts and questionable data are reported.

4. The test supervisor shall insure that testing and checkout work is conducted in a safe manner. Special safety precautions such as the following shall be utilized:

5.

a. Locking and tagging procedures

b. Barricades
c. De-energization or isolation of equipment before testing
d. Review of procedures with safety personnel
e. Erection of warning signs
f. Stationing of guards or watchmen
g. Maintenance of voice communications
h. Personnel orientation

6. The test apparatus shall be of the proper voltage class and rating for the test being preformed. Care shall be taken that the installation shall not be overstressed.

7. Initial resistance and low voltage tests of equipment shall be made with the equipment de-energized and with all electrical connections to the devices disconnected and locked out as required.

8. If resistance measurements on devices meet requirements, testing may proceed. Any short or ground shall be repaired, replaced, dried out, or otherwise corrected before the circuit is energized.

9. Full voltage tests on circuits and equipment shall be preformed only upon Electrical Contractor Project Manager representative's approval. Electrical Contractor Project Managers representative shall be present and witness full voltage tests. The manufacturer's representative may also witness full voltage tests.

10. At any stage of construction, and when observed, electrical equipment or systems determined to be damaged, faulty, or requiring repairs shall be reported to the Electrical Contractor Project Managers representative. Corrective action may require prior approval.

B. Specific Equipment Tests

Electrical tests of the following specific equipment shall include all tests required by NETA, unless noted otherwise herein. These tests are briefly described below.

1. Circuit Breakers – by Testing Agency

a. Check removable circuit breaker elements making sure aliments are true. Retighten loose bolts.

b. Place the drawout circuit breaker elements for each unit in its compartment.

c. Rack in and out breaker element and observe the 3 breaker element positions: In, Out, and In Between. Check to make sure that the breaker element shall be held rigidly in the "In" (operating) position without locking bolts.

d. Manually operate each circuit breaker and make sure that the mechanism operates freely and without binding.

e. Test the automatic circuit breaker trip. This shall be accomplished manually with power to the switchgear off.

2. Grounding System – by Testing Agency

a. Test main building loop and major equipment grounds to remote earth or directly referenced to an extremely low resistance (approx. 1 ohm) reference ground benchmark. Visually inspect systems, raceway, and equipment grounds to determine the adequacy and integrity of the grounding.

b. Test the ground grids for ground resistance to verify a maximum ground resistance of 2-5 ohms. Distribution Class lighting arrestor and towers are a maximum of 25 ohms.

1) The fall-of-potential method using 2 auxiliary electrodes, or other suitable approved method, shall determine ground resistance values.
2) Testing shall be performed as described in IEEE standard 81, IEEE Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Earth.

14.

19. 600 Volt Wire and Cable

a. Before energizing, measure the continuity and insulation resistance of every circuit external to equipment with a megger from each wire to all others, and ground.

a. Take insulation resistance measurements of the following:

1. Motor Feeders

With motors disconnected, measure insulation resistance of motor feeders from load side of contactors or circuit breakers. Repeat this test after motors are connected and just before energizing at perhaps lower voltage as limited by the maximum test voltage for the motor.

2. Lighting Panel Feeders

Measure insulation resistance of lighting and panel feeders with circuit breakers, lighting transformers, and panelboards connected, but with lighting branch circuit breakers or switches open.

3. Feeder Circuits

Measure insulation resistance of feeder circuits with connections to circuit breakers made up, but with breakers open and load not connected.

4. Lighting Branch Circuits

Measure insulation resistance after lamp holders, receptacles, fixtures, and other similar items are connected but before lamping.

5. Motor control Circuits (600V)

With pushbuttons and overcurrent devices connected, measure insulation resistance from phase-to-ground only. It may be necessary

to lift the neutral ground on the control transformers to perform this test. Also, isolate any control elements that should not be meggered.

6. Check cables and wires for proper identification numbering or color coding.

20. INSPECTION AND TEST OF ELECTRICAL INSTALLTION

A. Inspectors shall carefully review installation specifications issued for the project. They shall be familiar with applicable codes / standards and shall have copies available at the work locations for reference. Certain requirements may be defined in the specifications, but not called out on drawings, such as expansion joints in conduits, breathers, and drains, and support for cable in vertical conduit runs.

B. Additional inspections may be carried out by third parties to meet legal requirements. City, State, or similar inspection shall not alleviate the requirement for inspection defined here.

D. Aboveground Electrical:

1. Inspect the in-progress installation of electrical conduit and cable trays. This activity shall also include the welding for electrical supports. Establish a jobsite qualification procedure for electrical welders to ensure sound welds.

2. Inspect lighting panelboards and lighting installation.

3. Inspect and test bonding to ground for equipment and structures.

4. Inspect the in-progress installation of all cable. Medium and high voltage cable terminations shall be inspected.

5. Electrical heat tracing shall be inspected.

6. Inspect conduct seals and ensure that all seals have been poured after all cables have been pulled, tested, and Instrument Loop Checks completed. Document the inspection for each area / unit.

3.03 TEST AND INSPECTION REPORTS

A. In addition to requirements specified elsewhere, report the following:

1. Manufacturer's written testing and inspecting instructions.

2. Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.

3. Tabulation of expected measurement results made before measurements.

4. Tabulation of "as-found" and "as-left" measurement and observation results.

END OF SECTION 260510

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.

2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:

1. Division 26 section “Common Work Results for Electrical” for sleeves and sleeve seals.

1.03 SUBMITTALS

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

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

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

1. Alcan Products Corporation; Alcan Cable Division.

2. American Insulated Wire Corp.; a Leviton Company.

3. Belden

4. Encore Wire and Cable.

5. General Cable Corporation

6. Senator Wire & Cable Company.

7. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.02 CONNECTORS AND SPLICES

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

1. AFC Cable Systems, Inc.

2. Hubbell Power Systems, Inc.

3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M; Electrical Products Division.

5. Tyco Electronics Corp.

B. Connectors

1. Connectors shall be factory-fabricated connectors of size, ampacity rating, material, type, and class for application and service indicated.

2. Connectors shall be of the following types:
   a. Solderless, uninsulated high conductivity, corrosion resistant, compression connectors conforming to UL 467
   b. Insulated, indenter-type compression butt connectors
   c. Insulated, integral self-locking flexible shell, expandable spring connectors
   d. Uninsulated, indenter-type compression pigtail connectors

e. Welded-type connectors

C. Terminals:

1. Terminals shall be factory-fabricated connectors of size, ampacity rating, material, type, and class for application and service indicated.

2. Terminals shall be of the following types:
   a. Solderless, uninsulated, high conductivity, corrosion resistant, compression terminals conforming to UL 467 and IEEE 837
   b. Insulated, compression terminals
   c. Solderless, high-conductivity, corrosion resistant, hex screw type, bolted terminals
   d. Welded type terminals

2.03 OTHER SPLICING AND TERMINATING EQUIPMENT

A. Shrinkable Tubing

1. Subject to compliance with requirements of this Section, provide shrinkable tubing of the following types:
   a. Either irradiated modified polyvinyl chloride or irradiated modified polyolefin heat shrinkable tubing.
   b. Cold shrinkable tubing.

B. Tapes and Sealers

1. Vinyl Tapes shall be Flame-retardant, cold and weather-resistant, 3/4 inch or 1 1/2 inches wide, as required, and conforming to UL 510 and ASTM D 3005.
   a. For interior, dry location, provide 7 mils, conforming to ASTM D 3005 (Type I); Scotch (3M) No. 33, or approved equal.
   b. For exterior or damp and wet locations, provide 8.5 mils, conforming to ASTM D 3005 (Type II); Scotch (3M) No. 88, or approved equal.

2. Rubber Tapes shall be Ethylene-propylene, rubber-based, 30-mil splicing tape, rated for 130° C operation; 3/4 inch and wider conforming to ASTM D 1373 and Federal Specification HH-I-553 (Grade A); Scotch (3M) No. 130C, or approved equal.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: [Type THHN-THWN, single conductors in raceway].

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: [Type THHN-THWN, single conductors in raceway].

C. Feeders Installed below Raised Flooring: [Type THHN-THWN, single conductors in raceway].

D. Exposed Branch Circuits, Including in Crawlspaces: [Type THHN-THWN, single conductors in raceway].

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: [Type THHN-THWN, single conductors in raceway].

F. Branch below Slabs-on-Grade, and Underground: [Type THHN-THWN, single conductors in raceway].

G. Branch Circuits Installed below Raised Flooring: [Type THHN-THWN, single conductors in raceway].

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches** of slack.

D. Splicing

1. Splicing and terminating shall be as specified in this Section. Details of special splicing and terminating shall be as shown on the Contract Drawings. Any splicing or terminating methods other than those specified below, for which the

components are in accordance with the requirements of this Section, shall be submitted to the Engineer for approval

2. General Purpose Wires and Cables
   a. Splices in dry locations for sizes #10 and smaller shall use one of the following:
      1) Insulated, integral, self-locking flexible shell, expandable spring connectors shall be applied to the twisted conductors. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.
      2) Compression type, insulated butt connectors shall be applied to the butted conductors by means of an appropriate crimping tool, providing controlled indentation. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.
      3) Compression type, pigtail connectors shall be applied to the conductors by means of an appropriate crimping tool, providing controlled indentation. The connector shall be covered with a polyamide cap and two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.
   b. Splices in dry locations for sizes #8 and larger shall use all of the following:
      1) Connectors shall be split sleeve solderless type or solderless compression type.
      2) Fill indents of connectors with Scotchfil.
      3) Apply rubber splicing tape equal to the original insulation rating.
      4) Apply two, half-lapped layers of vinyl tape, or a shrinkable tubing

E. Terminations

1. Terminations in dry locations for sizes #10 and smaller shall be with compression terminals, insulated or uninsulated

2. Terminations in dry locations for sizes #8 AWG through 3/0 AWG shall be either solderless uninsulated compression crimp type ring tongue terminals or bolted hex screw type ring tongue lugs.

3. Terminations in dry locations for sizes 4/0 AWG and larger shall be solderless, uninsulated compression crimp type ring tongue terminals.

4. Terminations in wet locations shall be as dry location terminations above, plus cover the entire termination area with two, half-lapped layers of vinyl tape and apply two coats of sealer over the tape.

3.05 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test conductors #3 and larger for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment**.**

1. Underground distribution grounding.

1.03 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Ground rods.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

C. Grounding Bus: Rectangular bars of annealed copper, **1/4 by 2 inches** in cross section, unless otherwise indicated; with insulators.

2.02 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; **5/8 by 96 inches** in diameter.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. **12** AWG and smaller, and stranded conductors for No. **10** AWG and larger, unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from

raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

D. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: [10] ohms.

2. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of [five] times the applied force.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

1.06 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

1.07 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: [Steel] hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Hilti Inc.
3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least [25] percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with **single-bolt conduit clamps**.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. To Light Steel: Sheet metal screws.

6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. FRE: Fiberglas reinforced epoxy.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. PVC-RGS: PVC coated Type RGS conduit.

I. RGS: Rigid Galvanized Steel conduit.

J. RNC: Rigid nonmetallic conduit.

K. VFD: Variable frequency Drive.

L. XP: Explosion proof

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

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

1. AFC Cable Systems, Inc.

2. Alflex Inc.

3. Allied Tube & Conduit; a Tyco International Ltd. Co.

4. Anamet Electrical, Inc.; Anaconda Metal Hose.

5. Electri-Flex Co.

6. Manhattan/CDT/Cole-Flex.

7. Maverick Tube Corporation.

8. O-Z Gedney; a unit of General Signal.

9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3.

E. FMC: [Zinc-coated steel].

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: **Die-cast set-screw** type.

H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 METAL WIREWAYS

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

1. Cooper B-Line, Inc.

2. Hoffman.

3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type [**1**] [**12**] [**3R**], unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: **Screw-cover type NEMA 1**

E. Finish: Manufacturer's standard enamel finish.

2.03 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. **Prime coating, ready for field painting**.

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

a. Thomas & Betts Corporation.
b. Mono Systems, Inc.
c. Walker Systems, Inc.; Wiremold Company (The).
d. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

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

a. Butler Manufacturing Company; Walker Division.
b. Enduro Systems, Inc.; Composite Products Division.
c. Hubbell Incorporated; Wiring Device-Kellems Division.
d. Lamson & Sessions; Carlon Electrical Products.
e. Panduit Corp.
f. Walker Systems, Inc.; Wiremold Company (The).
g. Wiremold Company (The); Electrical Sales Division.

2.04 BOXES, ENCLOSURES, AND CABINETS

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

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. EGS/Appleton Electric.

3. Erickson Electrical Equipment Company.

4. Hoffman.

5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.

6. O-Z/Gedney; a unit of General Signal.

7. RACO; a Hubbell Company.

8. Robroy Industries, Inc.; Enclosure Division.

9. Scott Fetzer Co.; Adalet Division.

10. Spring City Electrical Manufacturing Company.

11. Thomas & Betts Corporation.

12. Walker Systems, Inc.; Wiremold Company (The).

13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. General

1. Interior Outlet Boxes
   a. Boxes shall be 4” square, minimum 2 1/8” deep, for up to two devices.
   b. Provide single gang tile ring as required for single device applications.

C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

F. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

2.05 SLEEVES FOR RACEWAYS

A. Per Section 260500 - Common Work Results for Electrical

2.06 SLEEVE SEALS

A. Per Section 260500 - Common Work Results for Electrical

2.09 BOXES AND FITTINGS FOR EXPLOSSION PROOF AREAS

A. Manufacturers: Subjects compliance with requirements, provide product by one of the following:

1. Appleton Electric

2. Akron Electric Inc.

3. Crouse-Hinds

EXECUTION

2.07 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: IMC.

2. Concealed Conduit, Aboveground: IMC.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): [LFMC].

4. Boxes and Enclosures, Aboveground: NEMA 250, Type 1.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: [**RGS**].

2. Exposed and Subject to Physical Damage: Rigid galvanized steel conduit. Includes raceways in the following locations:
   a. Mechanical rooms.

3. Concealed in Ceilings and Interior Walls and Partitions: **EMT**.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):

5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.

C. Minimum Raceway Size: ½ -inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid galvanized steel and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2.08 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

G. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

J. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of LFMC for [recessed and semirecessed lighting fixtures,]equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

K. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

L. Set metal floor boxes level and flush with finished floor surface.

2.09 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.

2. Warning labels and signs.

3. Equipment identification labels.

4. Miscellaneous identification products.

1.03 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.04 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.05 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.

2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.02 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.03 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.04 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.05 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength: 50 lb (22.6 kg), minimum.

3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

4. Color: Black, except where used for color-coding.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than [30 A]: Identify with orange self-adhesive vinyl label.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, [self-adhesive vinyl tape applied in bands]:

1. Fire Alarm System: Red.

2. Security System: Blue and yellow.

3. Mechanical and Electrical Supervisory System: Green and blue.

C. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape AND metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply [self-adhesive warning labels]. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.
c. Elevator Control Panels

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

G. Coordinate paragraph and subparagraphs below with electrical Sections in Divisions 2, 13, and 16. Delete items not in Project.

H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: [Self-adhesive, engraved, laminated acrylic or melamine label] or [Engraved, laminated acrylic or melamine label]. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: [Engraved, laminated acrylic or melamine label].
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Electrical switchgear and switchboards.
c. Emergency system boxes and enclosures.
d. Disconnect switches.
e. Enclosed circuit breakers.
f. Fire-alarm control panel and annunciators.
g. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.

3.02 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

E. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded [service, feeder, and branch-circuit] conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied].

2. Colors for 208/120-V Circuits:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
   d. Neutral: White.

3. Colors for 480/277-V Circuits:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following lighting control devices:

Indoor photoelectric switches.

1. Indoor occupancy sensors.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.03 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.04 SUBMITTALS

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.06 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.01 INDOOR OCCUPANCY SENSORS

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

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. Sensor Switch, Inc.
6. TORK.
7. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

PART 3 - EXECUTION

3.01 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.03 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.05 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions.

Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

3.06 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for room occupancy sensor switches

END OF SECTION 260923

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.

2. Isolated-ground receptacles.

3. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.04 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5362.
b. Hubbell; HBL5362.
c. Leviton; 5362.
d. Pass & Seymour; PS5362.

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; CR 5253IG.
b. Leviton; 5362-IG.
c. Pass & Seymour; IG6300.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.03 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; GF20.
   b. Hubbell

2.04 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
   b. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 2221PL for 120 V and 277 V.
   b. Hubbell; HPL1221PL for 120 V and 277 V.
   c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
   d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 2221L.
   b. Hubbell; HBL1221L.
   c. Leviton; 1221-2L.
   d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.05 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: **0.035-inch-thick, satin-finished stainless steel**

3. Material for Unfinished Spaces: **Galvanized steel**

4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.06 FLOOR SERVICE FITTINGS

A. Type: Modular, **flush-type**, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: **Round**, **solid brass** with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

2.07 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: **As selected by Architect**, unless otherwise indicated or required by NFPA 70 or device listing.

2. Wiring Devices Connected to Emergency Power System: **Red**.

3. Isolated-Ground Receptacles: **As specified above, with orange triangle on face**.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.02 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in **enclosed switches**, **switchboards**

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.05 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than **40 deg F** or more than **100 deg F**, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.06 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Cooper Bussmann, Inc.

2. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.02 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class RK1, time delay.

2. Feeders: Class RK1, time delay.

3. Motor Branch Circuits: Class RK1, time delay.

4. Other Branch Circuits: Class RK1, time delay.

3.03 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.04 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Fusible switches.

2. Nonfusible switches.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.

2. Current and voltage ratings.

3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Test results that comply with requirements.

7. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.

2. Altitude: Not exceeding 6600 feet.

1.07 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Lugs: Mechanical type, suitable for number, size, and conductor material.

5. Service-Rated Switches: Labeled for use as service equipment.

2.02 NONFUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.

2. Emergency lighting units.

3. Exit signs.

4. Lighting fixture supports.

B. Related Sections include the following:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.04 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.

2. Emergency lighting units including battery and charger.

3. Ballast.

4. Energy-efficiency data.

5. Life, output, and energy-efficiency data for lamps.

6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

   a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
   b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power and control wiring.

C. Qualification Data: For agencies providing photometric data for lighting fixtures.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.07 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metallized Film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least [**0.125 inch** minimum unless different thickness is indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

2.03 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   g. Integral Self-Diagnostics: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

3. Master/Remote Sign Configurations:

   a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
   b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.04 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.

7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

9. Integral Self-Diagnostics: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

B. 4000 K.

2.05 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, **12 gage**.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Division 26, Section 260533 “Raceways and Boxes for Electrical Systems” for raceways and boxes required for Division 27 work.

1.02 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.

2. Common communications installation requirements.

1.03 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.

4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.02 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 270500

SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Low-voltage control cabling.
2. Fire alarm wire and cable.
3. Identification products.

1.03 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Cable Runway Cable Tray: Identical rails and rungs without a loading depth.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

G. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

H. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

I. RCDD: Registered Communications Distribution Designer.

J. UTP: Unshielded twisted pair.

1.04 SUBMITTALS

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

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

B. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

C. Source quality-control reports.

D. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: **25** or less.

2. Smoke-Developed Index: **50** or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 LOW-VOLTAGE CONTROL CABLE

A. Paired Lock Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.

2. PVC insulation.

3. Unshielded.

4. PVC jacket.

5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.

2. PVC insulation.

3. Unshielded.

4. PVC jacket.

5. Flame Resistance: Comply with NFPA 262.

C. Paired Lock Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.

2. PVC insulation.

3. Unshielded.

4. PVC jacket.

5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.

2. Fluorinated ethylene propylene insulation.

3. Unshielded.

4. Plastic jacket.

5. Flame Resistance: NFPA 262, Flame Test.

2.02 FIRE ALARM WIRE AND CABLE

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

1. Belden

2. Berk-Tek

3. CommScope

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, **size as recommended by system manufacturer**.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.

2. Line-Voltage Circuits: No. 12 AWG, minimum.

3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors,Type TFN/THHN conductor insulation, copper drain wire, copper armor **with outer jacket** with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.03 IDENTIFICATION PRODUCTS

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

1. Brady Corporation

2. HellermannTyton.

3. Kroy LLC.

4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.04 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 INSTALLATION OF PATHWAYS

A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

D. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Install cable trays to route cables if conduits cannot be located in these positions.

3. Secure conduits to backboard when entering room from overhead.

4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.02 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

3.03 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.

2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is[**not**] permitted.

3. Signaling Line Circuits: Power-limited fire alarm cables **shall not** be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with

a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.04 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.05 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.06 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

END OF SECTION 280513

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Remote annunciator.

1.03 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.04 SYSTEM DESCRIPTION

A. Noncoded UL-Listed addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.05 PERFORMANCE REQUIREMENTS

1.06 SUBMITTALS

A. General Submittal Requirements:

1. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level III minimum.
c. Licensed or certified by authorities having jurisdiction.

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

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.

2. Include voltage drop calculations for notification appliance circuits.

3. Include battery-size calculations.

4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.

6. Include 1/8” = 1’- 0” scale floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Qualification Data: For qualified Installer.

1. Technicians shall be factory-authorized technicians

2. Technicians shall be NICET certified.

3. Installer shall have not less than 5 years experience with the manufacturer’s product line, and not less than 5 years experience in projects of similar scope to this project.

E. Field quality-control reports.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

2. Record copy of site-specific software.

3. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.
   d. Manufacturer's user training manuals.

4. Manufacturer's required maintenance related to system warranty requirements.

5. Abbreviated operating instructions for mounting at fire-alarm control unit.

G. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.08 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of fire-alarm service.

2. Do not proceed with interruption of fire-alarm service without General Contractor’s written permission.

1.09 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.10 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Edwards System Technologies (EST), as provided by a President's Partner Affiliate.

2. Siemens Building Technologies, Inc.; Fire Safety Division.(Cerberus), as provided by the local branch office.

3. SimplexGrinnell LP; a Tyco International company.(Simplex), as provided by the local branch office.

4. Notifier (Division of Honeywell), as provided by local NESCO Affiliate.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.

2. Duct smoke detectors.

3. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.

2. Operate an exterior bell on the flow of water in the sprinkler system.

3. Identify alarm at fire-alarm control unit and remote annunciators.

4. Unlock electric door locks in designated egress paths.

5. Release fire and smoke doors held open by magnetic door holders.

6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.

2. Low-air-pressure switch of a dry-pipe sprinkler system.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.

2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

3. Loss of primary power at fire-alarm control unit.

4. Ground or a single break in fire-alarm control unit internal circuits.

5. Abnormal ac voltage at fire-alarm control unit.

6. Break in standby battery circuitry.

7. Failure of battery charging.

8. Abnormal position of any switch at fire-alarm control unit or annunciator.

9. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

a. Smoke sensors shall additionally communicate sensitivity setting[and allow for adjustment of sensitivity at fire-alarm control unit].
b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 2 line(s) of 40 characters, minimum.

2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

    a. Initiating Device Circuits: Style D.
    b. Notification Appliance Circuits: Style Z.
    c. Signaling Line Circuits: Style 6.
    d. Install no more than 100 addressable devices on each signaling line circuit.

2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

    a. Initiating Device Circuits: Style B.
    b. Notification Appliance Circuits: Style Y.
    c. Signaling Line Circuits: Style 4.
    d. Install no more than 100 addressable devices on each signaling line circuit.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.

2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.

3. Record events by the system printer.

4. Sound general alarm if the alarm is verified.

5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

E. Notification Appliance Circuit: Operation shall sound in a temporal pattern.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium Sealed, or valve-regulated, recombinant lead acid.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2. Double-action mechanism requiring two actions to initiate an alarm, type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

3. Station Reset: Key- or wrench-operated switch.

4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.

2. Detectors shall be two-wire intelligent-type.

3. Integral Addressable Module (Intelligent Electronics): Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.

5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type indicating detector has operated and communication status.

7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

   a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
   b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
   c. Provide multiple levels of detection sensitivity for each sensor.

B. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

4. Each sensor shall have multiple levels of detection sensitivity.

5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.06 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 83 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:

a. 15 30 75 110 cd.
b. 15/75 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.

3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.

4. Flashing shall be synchronized with other units.

5. Strobe Leads: Factory connected to screw terminals.

6. Mounting Faceplate: Factory finished, **red**.

2.07 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.

C. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.

2. Connect new equipment to existing monitoring equipment at the supervising station.

D. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

E. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

F. Exterior Bell Devices. Install on flush-mounted back box, device near top of exterior wall. Coordinate final location with Authority Having Jurisdiction.

G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

H. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

I. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

J. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist 100-mph wind load with a gust factor of 1.3 without damage.

3.02 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Supervisory connections at valve supervisory switches.

2. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

3. Alarm initiating connections at sprinkler flow switches

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.04 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.05 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect or authorities having jurisdiction as required.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test audible appliances for the private operating mode according to manufacturer's written instructions.

5. Test visible appliances for the public operating mode according to manufacturer's written instructions.

6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

1. Provide pricing to the Owner after commissioning.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

1. Provide pricing to the Owner after commissioning.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111